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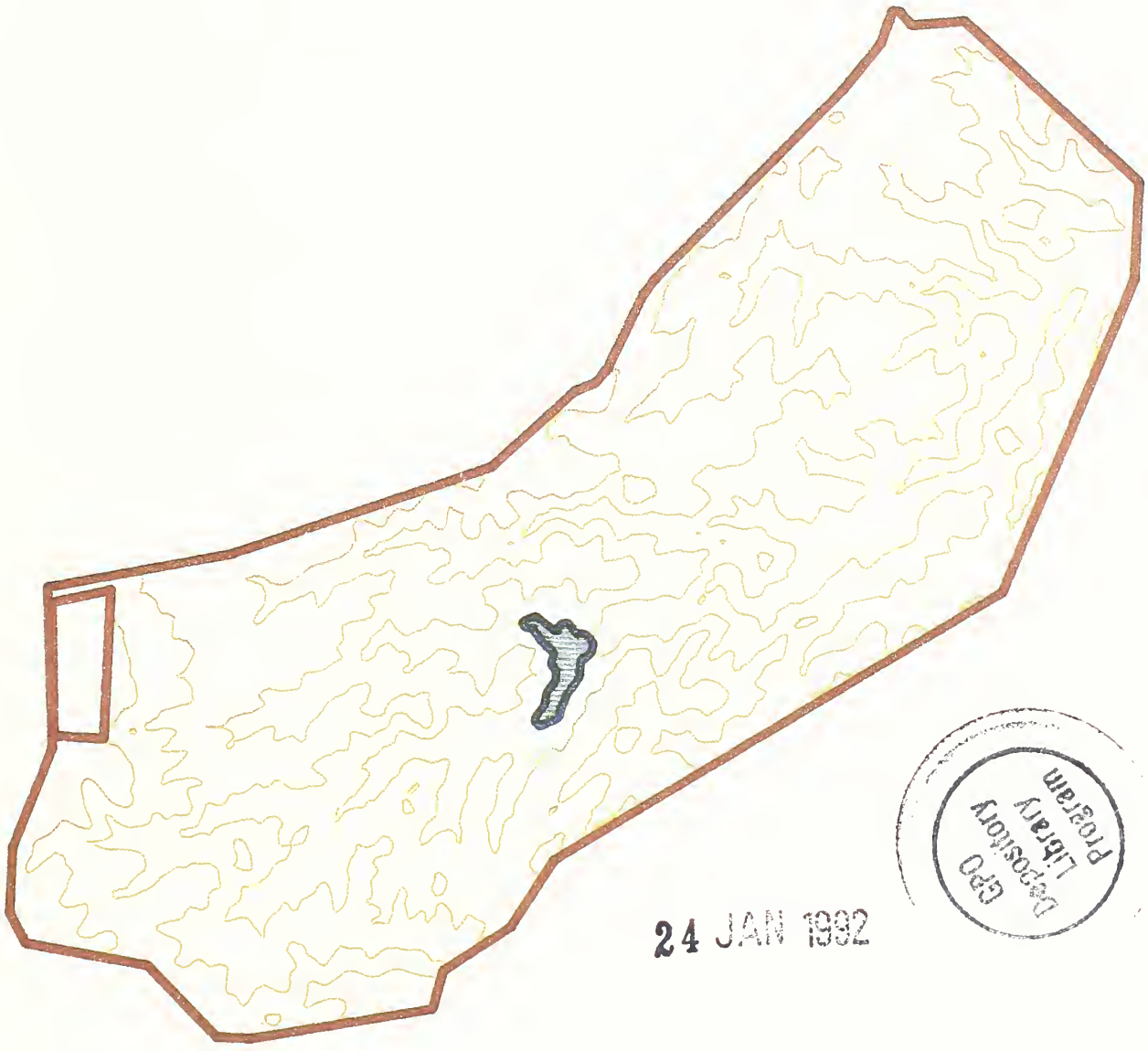
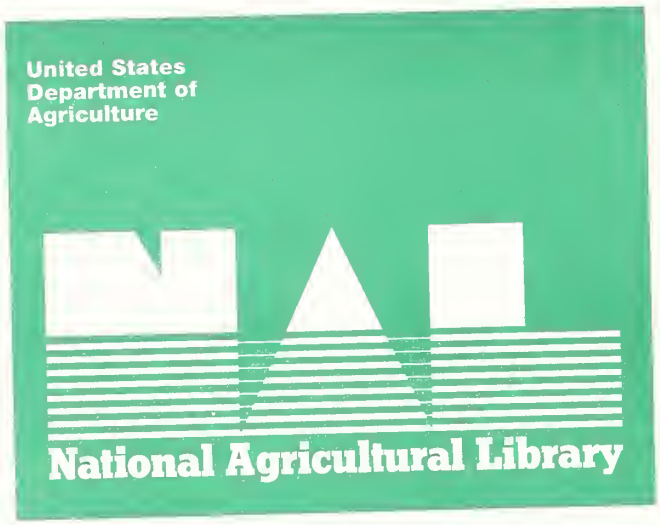
A Geographic Information Systems Guidebook

For Use In The Integrated Resource Management Process





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INTRODUCTION

A Geographic Information System (GIS) can help us reach better land management decisions by graphically displaying, charting, and analyzing lots of information in a relatively short period of time. In addition, GIS products help to document the project record for the NEPA process. This pamphlet is intended to be used as a "guidebook" of ways that GIS can be used in the Integrated Resource Management (IRM) planning process, the Southwestern Region's method for implementing Forest Plans. The IRM process in our Region is interdisciplinary, consisting of the following 13 phases which meet the legal requirements of the National Forest Management Act (NFMA) and the National Environmental Policy Act (NEPA):

1 - Define Nature of Decision and Review Forest Plan.
2 - Develop Project Concept and Scope.
3 - Conduct Extensive Reconnaissance.
4 - Prepare Feasibility Report.
5 - Check Budget Link.
6 - Conduct Intensive Reconnaissance, Survey or Design.
7 - Finalize and Compare Alternatives.
8 - Select Proposed Action.
9 - Prepare NEPA Documentation.
10 - Check Project Record.
11 - Prepare Project Action Plan.
12 - Implement Project.
13 - Monitor and Evaluate Results.

The 13-phase IRM process is documented in detail in a pamphlet that is published by the Southwestern Region entitled, "*Project Implementation Process for Integrated Resource Management*," USDA Forest Service, 1990 (Third Edition). In the IRM pamphlet, each phase of the process is described according to an outline which includes:

A. The objective of the phase.
B. A narrative description of the phase.
C. The products that result from the phase.

The GIS/IRM guidebook closely follows the Integrated Resource Management (3rd edition) format. The narratives and product discussions parallel the IRM pamphlet, but address how GIS applications can interface with the IRM process. In the main body of the guidebook, a general description of the relationship between GIS and IRM is given. The appendices give the results of a case study which provides GIS information products such as maps and tables that are used to illustrate the concepts presented, and lessons learned in developing this guidebook.

While GIS is one of the best technologies for producing many of the products that are required by the IRM process, it is not *always* the most appropriate tool. When a decision is made to utilize GIS technology, the user should also recognize that the quality of the products is directly dependent upon the quality and accuracy of the data used.

PHASE 1 - DEFINE NATURE OF DECISION AND REVIEW FOREST PLAN

Narrative

To support Phase 1 of the IRM process the GIS coordinator assists the ID team leader in methodically identifying and locating existing maps, resource databases, and other information. The GIS coordinator should assist the ID team in identifying data needs, resources, and quality of data. Goals & objectives of the Forest Land Management Plan can be represented by extracting LMP generated outputs and the associated standards and guidelines of the affected analysis area.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Provide maps and associated summary data of management and emphasis areas from Land Management Plan and other resource plans.
  - Notes on emphasis items from Forest Plan.
  - Description of the desired or expected future condition of land and resources within the project area.
- Identify, tabulate, and map data related to standards and guidelines, goals and objectives, and other management directions from the Land Management Plan when possible and pertinent.
  - Notes on project's potential contribution in meeting Forest Plan goals and objectives and other management direction.
  - Description of the desired or expected future condition of land and resources within the project area.
- Compare outputs associated with the proposed project, past accomplishments, and anticipated future activities.
  - Notes on project's potential contribution in meeting Forest Plan goals and objectives and other management direction.
- Query existing GIS information for project area. Methodically search, map, and summarize existing resources and other information.
  - Notes on project's potential contribution in meeting Forest Plan goals and objectives and other management direction.
  - Lists of Threatened, Endangered, and Sensitive (TE&S) species and their respective habitats, present and potential or historic.

PHASE 2 - DEVELOP PROJECT CONCEPT AND SCOPE

Narrative

To support Phase 2 the ID team leader works with the GIS coordinator to conduct the initial project Information Needs Assessment (INA). The INA should strive to identify data needed to answer questions related to this project. Data layers are identified and defined for the various levels of analysis and a data input schedule is set up. This data is presented to the group at the first ID team meeting in the form of maps and reports.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Map and summarize data specific to project objectives by alternatives when possible.
  - List of project objectives–specific and unique.
  - List of project specific issues.
- Define scope by mapping geographic area of influence for each issue or opportunity. (Project Specific).
  - List of project specific issues.
- Identify those land areas where issues, opportunities and concerns may be affected by the project. The scope of the project area is refined by zooming in on those areas that have the highest priority.
  - List of project specific issues.
- Identify area of influence regarding publics affected by activities in this Management Area.
  - List of potentially affected and interested publics.
  - Notes on preliminary public contacts made.
  - Notes on citizen's participation plan needs.
- Use any appropriate GIS displays for public involvement.
  - Notes on citizen's participation plan needs.
- Develop and/or list evaluation criteria (e.g. thresholds, maximum and/or minimum constraints.)

- List of preliminary evaluation criteria.

- Produce a map showing past, current, and other reasonably foreseeable activities that could influence the planning of this project.

  - List of other past, present, future projects contributing to potential cumulative effects.

- Prepare and use tabular statistical reports to aid in development of conceptual alternatives for the project.

  - Description of alternative themes.[1]

- Initiate transportation and harvest plan.

  - Description of alternative themes.

- Perform "What if" analysis of proposed activities to aid in development of alternatives concepts.

  - Description of alternative themes.

- Map concept of the alternatives when possible.

  - Description of alternative themes.

- Methodically search, map, and summarize existing resources and other information.

  - List of potentially affected TE&S species/habitats.

- All GIS data layers and information products.

  - Project record file established.

[1] The terminology in the "Description of alternative themes" product is taken verbatim from the Integrated Resource Management (3rd edition) publication. This may confuse some readers because the word "theme" has many meanings. As used here, "alternative theme" refers to the main motif or management emphasis associated with a project. It does not refer to a physical, GIS, thematic map layer.

PHASE 3 - CONDUCT EXTENSIVE RECONNAISSANCE

Narrative

GIS is used in this phase to provide base data for resource specialists to use for extensive reconnaissance. In this phase, data input begins to be collected specifically for this project. Public comments, agency concerns, and the use of additional skills may cause additional interpretive outputs. The outputs may take the form of maps, reports, and statistical data which describe the resources and physical features within the project area.

The ID team identifies issues and evaluation criteria from public involvement, and agency concerns and opportunities which are specific to the project. The ID team, including the GIS coordinator, determines additional data needs based on the issues and evaluation criteria.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Update GIS maps and data bases as information is validated.
  - Notes on verification, additions or changes to issues, interested publics, project objectives, evaluation criteria, or desired future condition.
- Prepare associated maps and reports to include existing conditions based on existing information and extensive reconnaissance, identifying conflicts, and Issues, Concerns, and Opportunities (ICO's).
- 1. Update GIS maps and associated data bases as information is refined.
  2. Initiate paper transportation and harvest plan.
  3. Produce a map showing other past, current, and other reasonably foreseeable activities that could influence this project.
  - Notes or maps on resource information, physical features, road conditions, R/W needs and any other special information that may be helpful during subsequent project phases.
- Compare existing information with information needed to complete the feasibility report and gather missing extensive information.
  - Notes on technical, economic, and public feasibility.
- Use any appropriate GIS displays for public involvement.
  - Notes on verification, additions or changes to issues, interested publics, project objectives, evaluation criteria, or desired future condition.

- Notes on public comments.

- Notes on additional emerging alternatives.

- Develop a map for each alternative.

  - Notes on additional emerging alternatives.

- Identify specific information needed to complete intensive evaluation and analysis using GIS products.

  - Notes on intensive reconnaissance needs.

- Methodically search, map, and summarize existing resources and other information.

  - Notes on refinement of potentially affected TE&S species and their respective habitats, present and potential or historic.

- Query existing GIS information for project area.

  - Notes on refinement of potentially affected TE&S species and their respective habitats, present and potential or historic.

PHASE 4 - PREPARE FEASIBILITY REPORT

Narrative

To support Phase 4, GIS products are used to depict the tentative alternative themes and/or other relevant information. This facilitates the line officers' assessment of technical, social, and economic feasibility.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Define scope by mapping geographic area of influence of each issue or opportunity (project specific).
  - Description of nature of the decision to be made.
  - Project location (map).
  - List of project specific issues.
- Produce a map showing other past, current, and other reasonably foreseeable activities in the vicinity that could influence the planning of this project.
- Compare outputs associated with the proposed project, past accomplishments, and anticipated future activities.
  - Project location (map).
- Map specific project objectives by alternative; when possible
  - List of project specific objectives.
- Perform "what if" analysis of proposed activities to aid in development of alternative concepts.
- Depict developing alternatives and model economic evaluation.
- Develop a map for each alternative.
  - Description of alternative themes.
- Prepare and use tabular statistical reports to aid in development of alternative concepts.
  - List of evaluation criteria.

- Use products to develop feasibility report.
- Initiate "paper" transportation and harvest plan.
- Identify area of influence regarding publics affected by Management Area/Activity.
    - Identification of responsible official.
    - Statement of Forest Plan consistency.
    - Statement of technical feasibility, including special skills necessary.
    - Statement of public feasibility, including cultural issues, concerns, and opportunities.
    - Statement of economic feasibility, including outputs, effects, activities, receipts, and costs.
    - Statement of legal consistency, including all directly applicable laws and regulations.
    - Statement of line officer approving or disapproving feasibility report.

PHASE 5 - CHECK BUDGET LINK

Narrative

GIS is used as an aid in developing and updating project schedules such as the 10-year implementation schedule for the Forest Plan. A GIS data base could be used as an aid to track potentially affected publics and to inform groups regarding proposed projects. The output can be either maps or tables.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Refine, update and display present and future projects in space and time.
  - Updated project action plans.
- Map the 10-year timber sale schedule and other resource schedules.
  - Updated Forest 10-year Implementation Schedule.
- Use a data base of affected publics that could be linked by theme and/or location to the GIS to aid in the development of a public participation plan.
- Maps and reports for public involvement.
  - Detailed citizen's participation plan.

PHASE 6 - CONDUCT INTENSIVE RECONNAISSANCE, SURVEY, OR DESIGN

Narrative

This is the culmination of the data collection. All information relevant to project analysis and evaluation is incorporated in the GIS and/or associated data bases. This is a critical point to ensure the desired accuracy levels of input and collection standards have been met.

Standards for site specificity and compatibility with evaluation criteria, alternative formulation standards, and cumulative effects, need to be verified at this point.

The line officer's final decision will be enhanced with the reliability and relevance of the products built during this phase.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Update resource information from Phases 1 through 4 on maps generated in Phase 5. (e.g., refine Cutting Unit boundaries, delineate cultural sites, transportation/harvest plan, other sensitive resource information, and GIS layers).

- Refine alternatives generated in Phase 4.

- Tie Global Positioning System (GPS) and Remote Sensing tools to GIS during the intensive reconnaissance phase.

- Gather and display information pertaining to evaluation criteria.

- Finalize GIS layers necessary for project evaluation. This would include any geographic data that has not yet been entered into the system.

  - Activity unit boundaries marked on-the-ground by topographic features, roads, streams, or "flagged" lines sufficient enough so that they can be located. Resource input is recorded.

  - Project transportation plan. Include right-of-way needs and Resource Access objectives.

  - All needed roads are "flagged" with "control points" and "critical points" clearly identified and marked.

  - Land lines needing surveying and posting identified.

  - Borrow pits or rock sources located.

- Revised issues, project objectives, and evaluation criteria, if necessary.

- TE&S species/habitats survey completed and documented.

- Map and quantify information regarding direct, indirect, and cumulative effects gathered from intensive reconnaissance while always realizing that the scope of the project is limited.

  - Notes on environmental effects.

- Map and quantify areas of concern to be monitored over time.

  - Notes on project monitoring needs.

PHASE 7 - FINALIZE AND COMPARE ALTERNATIVES

Narrative

GIS is interfaced with other existing models and data bases. Examples include: FORPLAN, TEAMS and eventually one integrated data base. These tools are most powerful during this phase of the IRM process. The alternative formulation criteria are set up and used to finalize alternatives based on resource specialist input generated during intensive reconnaissance. A tabulation of outputs and effects of each alternative is displayed for the line officers' evaluation. These outputs include the resultant long-term, direct, indirect, and cumulative effects, and connected actions anticipated to occur if a given alternative is implemented. By developing "what if" scenarios using GIS, temporal and spatial effects are evaluated.

Additional mitigation measures are also displayed to further reduce environmental effects. Display tables and maps can be used in many ways. For instance, miles of road, acres of old growth, forage to cover ratios, and many other criteria can be displayed both spatially and in table form.

Overlay mapping techniques allow for various resource layers to be "mixed and matched" quickly. The power to do quick and accurate analysis of a wide range of potential resource interactions is phenomenal when GIS is used properly.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Use GIS "analysis" tools such as overlaying, weighting, "what if" queries, buffering, viewshed analysis, temporal and spatial limitations, potential conflicts and other pertinent resource analysis.
  - Descriptive evaluation criteria quantified for each alternative.
  - Environmental and socioeconomic evaluation criteria quantified for each alternative.
  - Cumulative effects quantified for identified other past, present, and future projects.
  - Non-quantifiable evaluation criteria narratives for each alternative.
  - Notes and rationale for whether or not identified environmental effects are significant (National Environmental Policy Act definition).
  - TE&S Biological Evaluation (BE) for all alternatives.
  - Notes on recommended course of action including environmental documentation.
- Acreage and output summaries.

- Use GIS to generate final alternatives as modified by resource specialists and line officers to include maps and data by alternative.

- Interface GIS data and spatial capabilities with other computer decision support and analysis tools to compare alternatives, plan a solution set, or create a socioeconomic model.

    - Environmental and socioeconomic evaluation criteria quantified for each alternative.

- Use GIS and other modeling and simulation tools to address indirect effects, cumulative effects, and other NEPA related items (i.e., connected actions, long-term effects).

    - Cumulative effects quantified for identified other past, present, and future projects.

PHASE 8 - SELECT PROPOSED ACTION

Narrative

In this phase, GIS helps the responsible official to select an alternative for implementation. The line officer chooses an alternative developed by the Interdisciplinary Team (IDT) or one derived from combining or modifying the existing range of alternatives. It is also possible that the line officer directs the IDT to formulate an entirely different alternative. GIS is an excellent tool to quickly respond to these types of requests. The GIS data base and final products are updated to reflect any revisions.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Final display of selected alternative.
  - Selected alternative to be implemented or a preferred alternative.

PHASE 9 - PREPARE NEPA DOCUMENTATION

Narrative

In order to display compliance with pertinent laws and regulations such as NEPA, pertinent GIS maps, reports and statistical summaries are included in the documentation. This information should help to support the basis on which the line officer selected the preferred alternative.

The alternatives and their associated environmental consequences which include direct, indirect, and, cumulative effects are readily displayed by GIS. These applications can also assist in answering queries from appellants or potentially affected publics.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Prepare pertinent maps and products for NEPA documentation
  - Environmental documents EA, FONSI, EIS.
- Prepare products for public involvement
  - Conflict resolution documentation or appeal decision if necessary.

PHASE 10 - CHECK PROJECT RECORD

Narrative

The IRM pamphlet, 3rd edition, describes the utility of the GIS at Phase 10. This phase captures the results of the previous phases in automated form and may require more digitizing and data entry for editing and updating.

At this phase, the project team assures that the final project design and relational data have been incorporated into the District and Forest integrated data base and GIS systems.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Store all relevant outputs and any necessary references to data which includes maps, tabular statistics and summaries. Some of this information is archived electronically to facilitate future analysis.

  - A single project packet and index which includes *all* information pertinent to the project and supporting the final decisions made in earlier phases. Documents created after this phase should also be included as they are ready; therefore, additional space should be set aside for them.

  - Digitized geographic information reflecting final project design incorporated in Forest GIS.

  - The Integrated Resource Data base is updated to reflect the final project design.

PHASE 11 - PREPARE PROJECT ACTION PLAN

Narrative

The use of GIS can help facilitate the development and use of the project implementation plan. This plan outlines the specific instructions necessary to implement the project decision. It is important that final maps and associated information display the specific details identified in the action plan.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Create final project implementation maps, surveys, plans and designs.
  - Final maps, photos, plans, and designs.
  - Final implementation guides and/or prescriptions.
  - Specific schedule of all activities associated with the project (project work plan).
- Create final data collection standards and format for project monitoring and evaluation.
  - Post-project monitoring and evaluation schedule.
- Generate necessary contract maps.
  - Contract documents developed, if appropriate.

PHASE 12 - IMPLEMENT PROJECT

Narrative

This is the "do it" phase of the project. The design is laid out on the ground and final checks are made by the project team and responsible official. GIS maps, overlays and reports are used as needed to help implement the project and to display the progress of implementation. As the project is administered and monitored, changes will be incorporated in the GIS layers and associated relational data bases.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Reference and apply GIS products, as needed.
  - Awarded Contracts if needed.
  - Completed project with appropriate project administration.
  - Resource objectives met.
  - Forest Plan implemented.
  - Project design amended as needed.
  - Project "as built" description, maps, etc.
- Revise or amend pertinent maps and products as implementation is modified from final project plan.
  - Project design is amended as needed.

PHASE 13 - MONITOR AND EVALUATE RESULTS

Narrative

The GIS can prove useful in a future evaluation of the project on the ground. GIS can provide a relatively easy way to locate projects and evaluate whether or not the treatment met the long term objectives and goals for the area. During and after implementation it may be necessary to update the GIS and related data bases. Tools such as remote sensing can provide this capability and will allow for accurate appraisals of the progress made after implementation takes place.

GIS can also provide a tool for projecting into the future. The entire 10-year implementation schedule could be looked at and the end-results of the project simulated graphically and statistically.

LEGEND FOR DISPLAYING THE LINK BETWEEN GIS AND IRM

- GIS activities and/or conceptual products
  - IRM Products as listed in IRM pamphlet (3rd Edition)

- Use GIS to compare accomplished outputs and resultant area conflicts with the standards and guidelines and planned outputs from the Forest Land Management plan.
  - Project Monitoring Report that documents the results of project design. Line officers should monitor projects each year using an interdisciplinary review approach as scheduled in Phase 11.
  - Updated 10-year implementation schedule showing project accomplished.
  - Updated GIS and related data bases.
  - Forest Plan monitoring information.
- Incorporate remote sensing to aid in monitoring and evaluation of the ongoing project.
  - Project Monitoring Report provides documentation of project design results. Line officers should monitor projects each year using an interdisciplinary review approach as scheduled in Phase 11.
  - Updated 10-year implementation schedule showing project accomplished.
  - Updated GIS and related data bases.
  - Forest Plan monitoring information.

APPENDIX A - CASE STUDY

Introduction

The following case study illustrates some specific GIS/IRM analysis applications of the concepts just presented in the body of this guidebook.

In each phase of this appendix a narrative precedes a display of the sample GIS product(s). These narratives explain the (mostly hypothetical) conditions encountered by the Interdisciplinary Team (IDT) during the analysis. The potential number of products that could be produced using GIS technology is limitless. Because of this, we have artificially limited the scope of our case study to a *partial analysis* of the following five concerns:

1. Vegetative Health and Growth.
2. Wildlife Habitat.
3. Soil and Water.
4. Visual Quality.
5. Cultural Resources.

One to three GIS products have been produced per phase to give you a sampling of the kinds of specific analysis applications available in terms of integrating GIS technology with the IRM project implementation process. Many of the products produced for the case study require "layering" of several maps to make the final product. Two examples of the "assembly" steps are found in the first product of this Case Study and in Appendix B.

In a few instances, to limit guidebook size, we verbally explain a potential product without actually producing the product. Both kinds of products are included to help you think about and explore possible applications for your analysis effort.

Please keep in mind that the following examples are not intended to be viewed as a *complete analysis*.

GIS/IRM ANALYSIS ACTIVITIES THAT MAY PRECEDE PROJECT LEVEL ANALYSIS

Narrative:

The District management team was directed by the Ranger to perform a quick analysis of the Deer Creek Watershed to explore potential opportunity or problem areas that might lead to projects which would contribute to desired future conditions outlined in the forest plan. If such areas emerged, specific project objectives and further analysis would be undertaken in those areas.

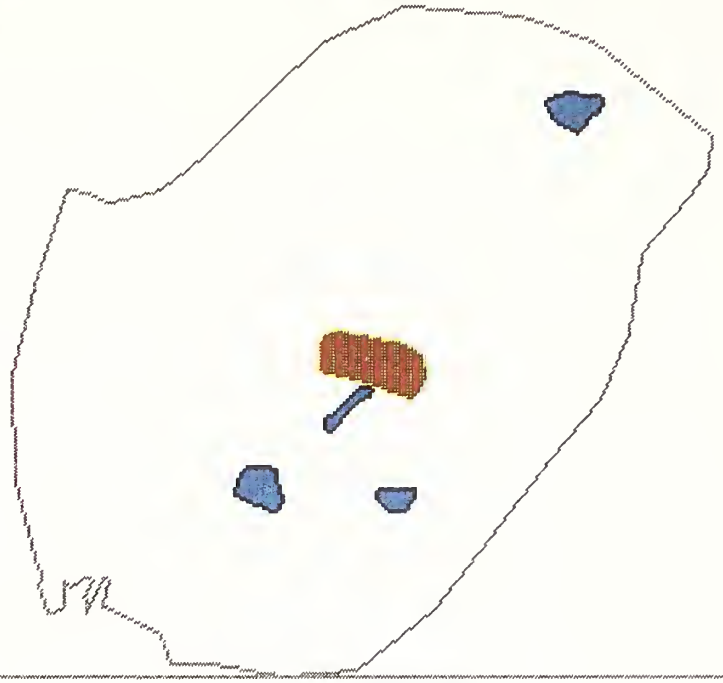
The District Ranger had selected this area for analysis based on existing Ranger District personnel knowledge of the area. Several members of the team were aware of various opportunities and problems such as poor forest health, lack of habitat diversity, and loss of soil along several existing roads. The results of this initial analysis are expected to help the District Ranger and District Interdisciplinary Team identify places where specific project concepts could be developed that would contribute to the goals and objectives described in the Forest Plan.

Products:

1. A map that shows the "layering" technique frequently used to build the final GIS product.

2. A composite map showing all of the elements under consideration. This map depicts the presumed problems and opportunities in the Deer Creek Watershed which may merit further analysis efforts.

3. A table summarizing opportunity or problem areas within the Deer Creek Watershed. Most of the information displayed, at this point, is not ground verified (Table 1).



DEER CREEK WATERSHED
INITIAL ASSESSMENT
PROBLEMS & OPPORTUNITIES

LEGEND:

- MISTLETOE
- POSSIBLE OLD GROWTH
- IPS INFESTATION
- RECENT WILDFIRE
- SENSITIVE SOILS
- EXISTING PROBLEM ROADS

INITIAL ASSESSMENT – PROBLEMS & OPPORTUNITIES IN DEER CREEK WATERSHED

81900 ACRES IN THIS WATERSHED

GIS TECHNIQUE: LAYERING

SCALE 1: 175000.

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TABLE 1
SUMMARY OF CONCERNS AND OPPORTUNITIES IN THE PROJECT AREA

Concerns and Opportunities	Area of Length
FIRE	434 ACRES
IPS	546 ACRES
MISTLETOE	4241 ACRES
OLD GROWTH	2197 ACRES
SENSITIVE SOILS	1100 ACRES
PROBLEM ROADS	6 MILES

PHASE 1 - DEFINE NATURE OF DECISION AND REVIEW THE FOREST PLAN

Narrative:

This step in the process narrows the scope for specific project analysis from an entire watershed to a potential project area of about 11,000 acres. Of course, cumulative effects analysis for any ecosystem or specific resource affected by the proposal may necessitate looking beyond this artificial analysis boundary. Generally speaking, however, most site specific project analysis will occur within this project proposal boundary. The potential project area was selected because it had the apparent largest concentration of problems and/or opportunities within the watershed. These included the existence of historic fire and present fire hazards, insect outbreaks, mistletoe, problem roads and problem soils. Much of the information generated at this phase of the analysis is generalized and comes from the IDT's personal knowledge of the area.

Part of the information gathered during the review of the Forest Plan included: Proposed campground construction near Blue Lake; Visual Quality Objectives for the entire area; and two Management Areas within the proposed analysis boundary. In this case, Forest Plan Management Area A is to be managed for a wildlife emphasis; while Management Area B is to be managed for a timber production emphasis. All information gathered during this phase comes from existing documentation or from personal knowledge of individuals. The validity of the information will be determined as the process proceeds.

The products displayed are typical examples of GIS uses in Phase 1. These examples only scratch the surface of the information that you will likely find in your discussions with knowledgeable people and review of the Forest Plan.

Products:

1. Map of proposed project analysis area which displays the presumed existing conditions. This is similar to the preceding map of the Deer Creek watershed. However, this map "zooms" in on the potential project area within the Deer Creek watershed.

2. Map that displays information extracted from the Forest Plan (Visual Quality Objectives, Management Areas, etc.).

3. Table that summarizes the estimated existing Vegetation Structural Stages and desired future managed Vegetation Structural Stages for Management Area "A" (Table 2).

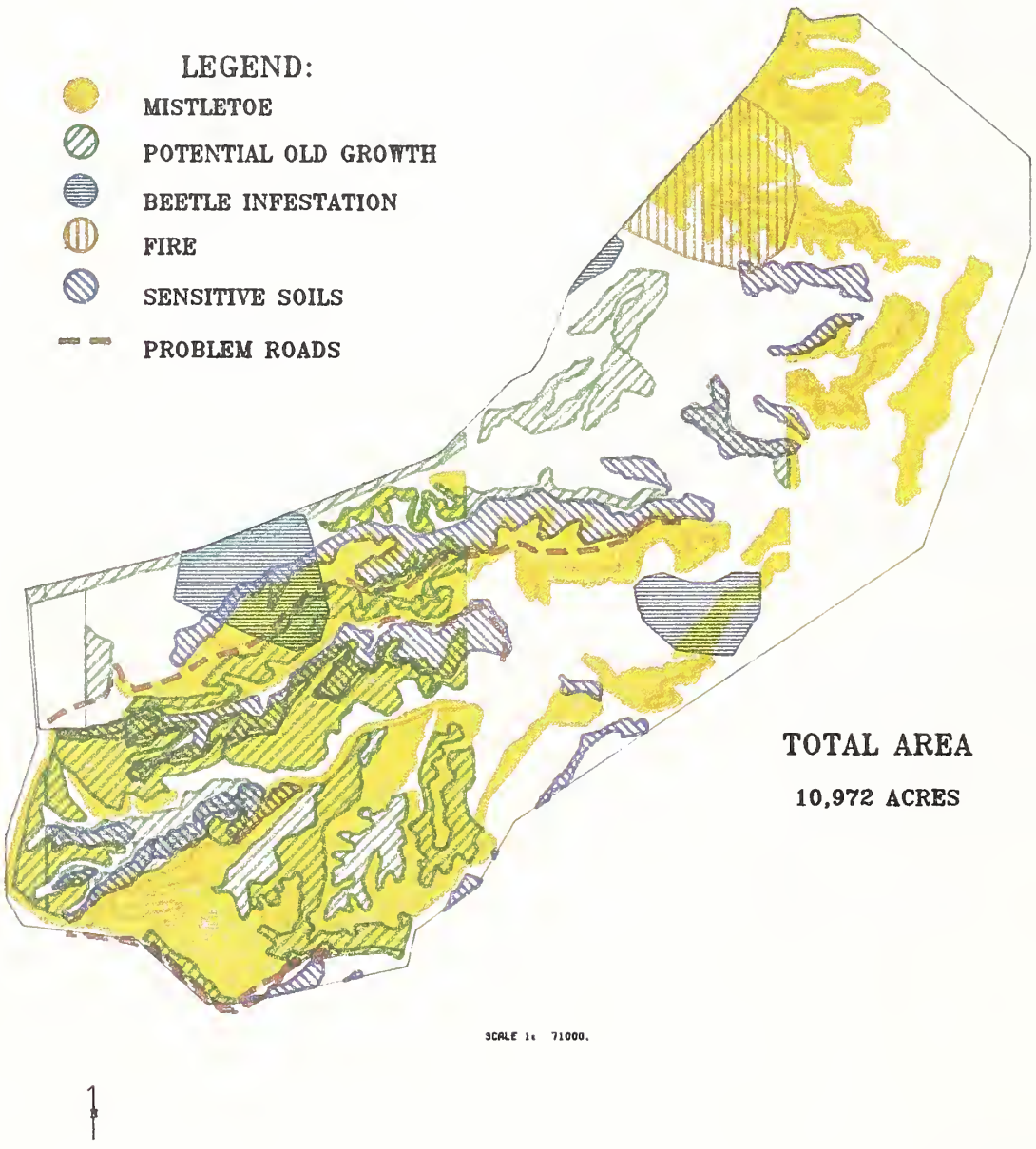
TABLE 2
PHASE 1, PRODUCT 3

Estimated Existing and Desired Future Managed Conditions of Vegetation in Management Area "A"

Mgt. Area "A" (Ponderosa Pine Type - 200 year Forest Age)

Vegetation *Structural Stage*	Estimated Existing *Condition* (% Mgt. Area)	Desired Future *Managed Condition* (% Mgt. Area)
Grass-Forb/Shrub (DBH: 0-0.9")	5	10
Seedling-Sapling (DBH: 1.0-4.9")	0	10
Young Forest (DBH: 5.0-11.9")	15	20
Mid-Aged Forest (DBH: 12.0-17.9")	40	20
Mature Forest (DBH: 18.0" plus)	20	30
Old Growth (See R3 definition)	20	10
Totals:	100	100

PHASE I: AREA SELECTED FROM PREPHASE ANALYSIS



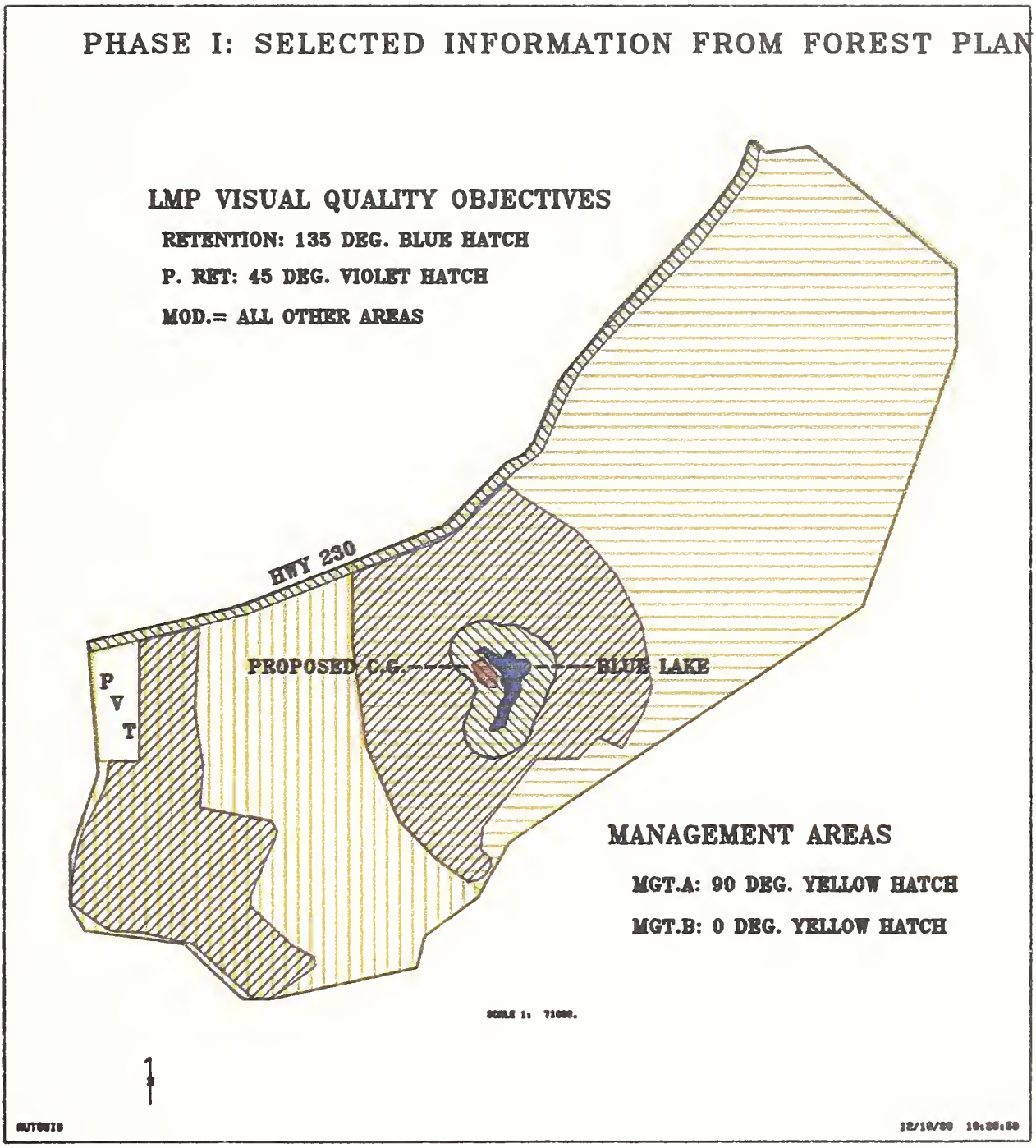

PHASE I: SELECTED INFORMATION FROM FOREST PLAN
LMP VISUAL QUALITY OBJECTIVES
RETENTION: 135 DEG. BLUE HATCH
P. RET: 45 DEG. VIOLET HATCH
MOD.= ALL OTHER AREAS
HWY 230
PROPOSED C.G.
BLUE LAKE
P
V
T
MANAGEMENT AREAS
MGT.A: 90 DEG. YELLOW HATCH
MGT.B: 0 DEG. YELLOW HATCH

TABLE 2
PHASE 1, PRODUCT 3

Estimated Existing and Desired Future Managed Conditions of Vegetation in Management Area "A"

Management Area "A" (Ponderosa Pine Type - 200 year Forest Age)

Vegetation Structural Stage	Estimated Existing Condition (% Mgt. Area)	Desired Future Managed Condition (% Mgt. Area)
Grass-Forb/Shrub (DBH: 0-0.9")	5	10
Seedling-Sapling (DBH: 1.0-4.9")	0	10
Young Forest (DBH: 5.0-11.9")	15	20
Mid-Aged Forest (DBH: 12.0-17.9")	40	20
Mature Forest (DBH: 18.0" plus)	20	30
Old Growth (See R3 definition)	20	10
Totals:	100	100

PHASE 2 - DEVELOP PROJECT CONCEPT AND SCOPE

Narrative:

Some key issues and concerns involving the project area were brought to the attention of the District Ranger (DR). The State Game and Fish Department informed the District Ranger that significant portions of the analysis area lack in forage for big game. In addition, several small businesses indicated an interest in obtaining house logs for an increasing house log market. The District silviculturist discussed the topic of forest health in light of the mistletoe infections, recent wildfire and pine beetle outbreaks. After considerable interdisciplinary interaction, the team tentatively prioritized these issues for potential treatment in this order:

1. Lack of big game forage

2. Dwarf mistletoe infections

3. Need for house logs

At this point in the analysis the recent wildfire and pine beetle infestation were thought to have as many beneficial effects as negative effects to the ecosystem. Consequently, these topics were not prioritized for treatment, based on current information. Product 1 displays, by agreed-to priorities, where the above conditions are thought to exist.

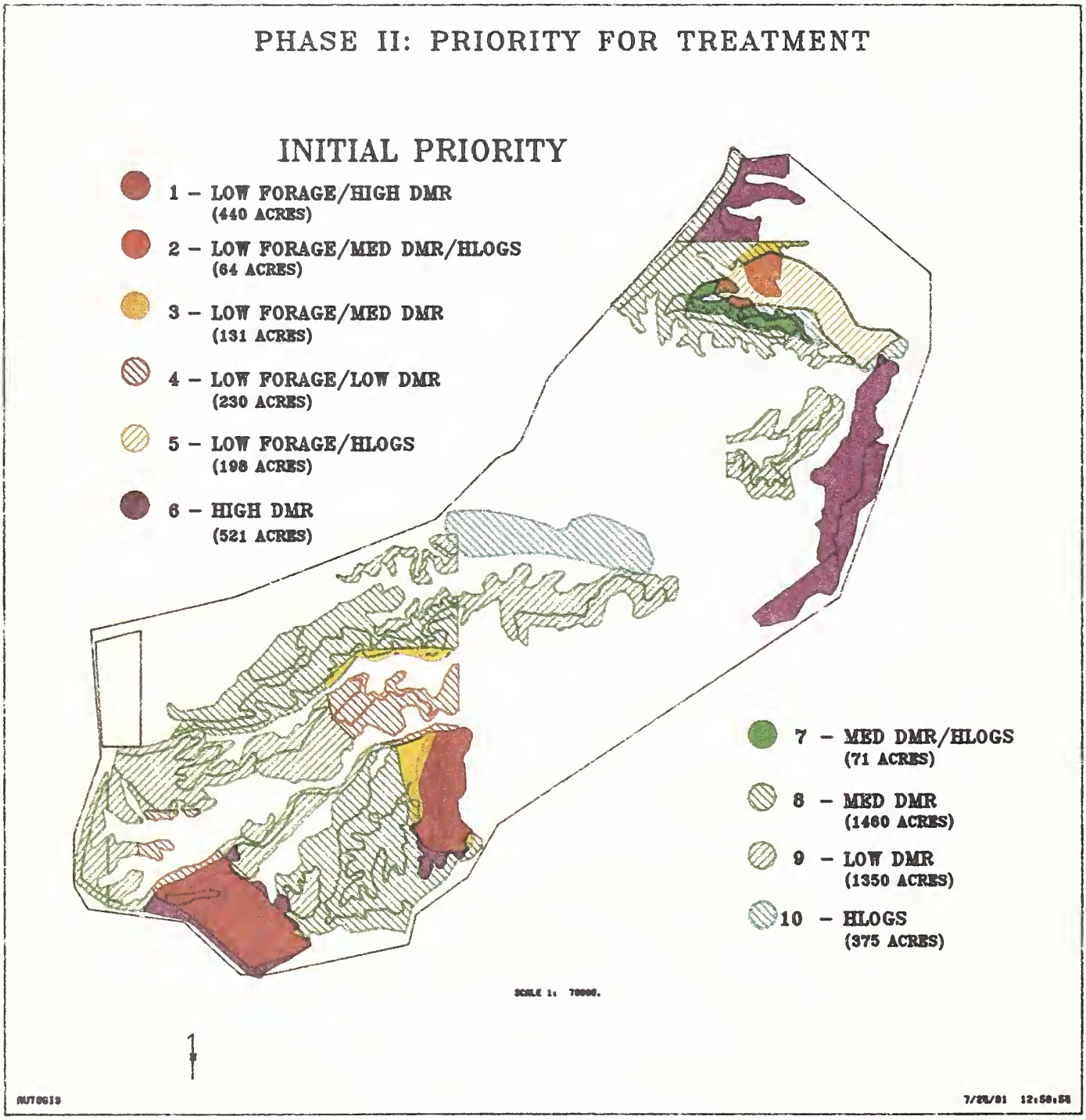
You will note that the IDT has broken the above categories into High, Medium and Low ratings. With GIS technology it is relatively easy to display and change information sets as you proceed from unverified information to verified information. This information set is not field verified.

During this phase, we needed to determine our information needs for the concept, feasibility, and decision stages of our project. The IDT conducted a preliminary Information Needs Assessment (INA) for this emerging project proposal. A chart and narrative, found in Appendix C, explain how this process might proceed regarding one issue. Generally, the information reliability and intensity will increase for each relevant resource as you move through the IRM process.

Products:

1. Priority for treatment map and acreage summary.

2. Chart showing INA format and level of information needed at each of four IRM phases (as it relates to one issue). The table is found in Appendix C (Table 3).


PHASE II: PRIORITY FOR TREATMENT
INITIAL PRIORITY
1 – LOW FORAGE/HIGH DMR
(440 ACRES)
2 – LOW FORAGE/MED DMR/HLOGS
(64 ACRES)
3 – LOW FORAGE/MED DMR
(131 ACRES)
4 – LOW FORAGE/LOW DMR
(230 ACRES)
5 – LOW FORAGE/HLOGS
(198 ACRES)
6 – HIGH DMR
(521 ACRES)
7 – MED DMR/HLOGS
(71 ACRES)
8 – MED DMR
(1460 ACRES)
9 – LOW DMR
(1350 ACRES)
10 – HLOGS
(375 ACRES)
SCALE 1: 78000.
AUTOCAD
7/20/01 12:50:58

PHASE 3 - CONDUCT EXTENSIVE RECONNAISSANCE.

Narrative:

The extensive reconnaissance added some information relating to past, present and future activities within the watershed (though not displayed here). Stand examination information from within the proposed project area was also incorporated at this time. Topographic maps within the proposed project planning area already existed within the GIS. This information was used to build a three-dimensional display of the seen area from the proposed campground near Blue Lake (see Product 1). Finally, a new set of information was provided by the Forest Archeologist in the form of roughly delineating areas likely to have cultural resource sites.

The stand examination boundaries and associated data, now in the GIS, were important to the IDT throughout the remainder of the analysis. In this case the IDT used the stand data to do gross predictive modeling for displaying forage areas and likely spotted owl habitat. Other interpretations were undertaken from this and other existing information sources and the general field reconnaissance to interpret intensity levels of pine beetles, occurrence of high risk soil erosion and probable fire intensity levels.

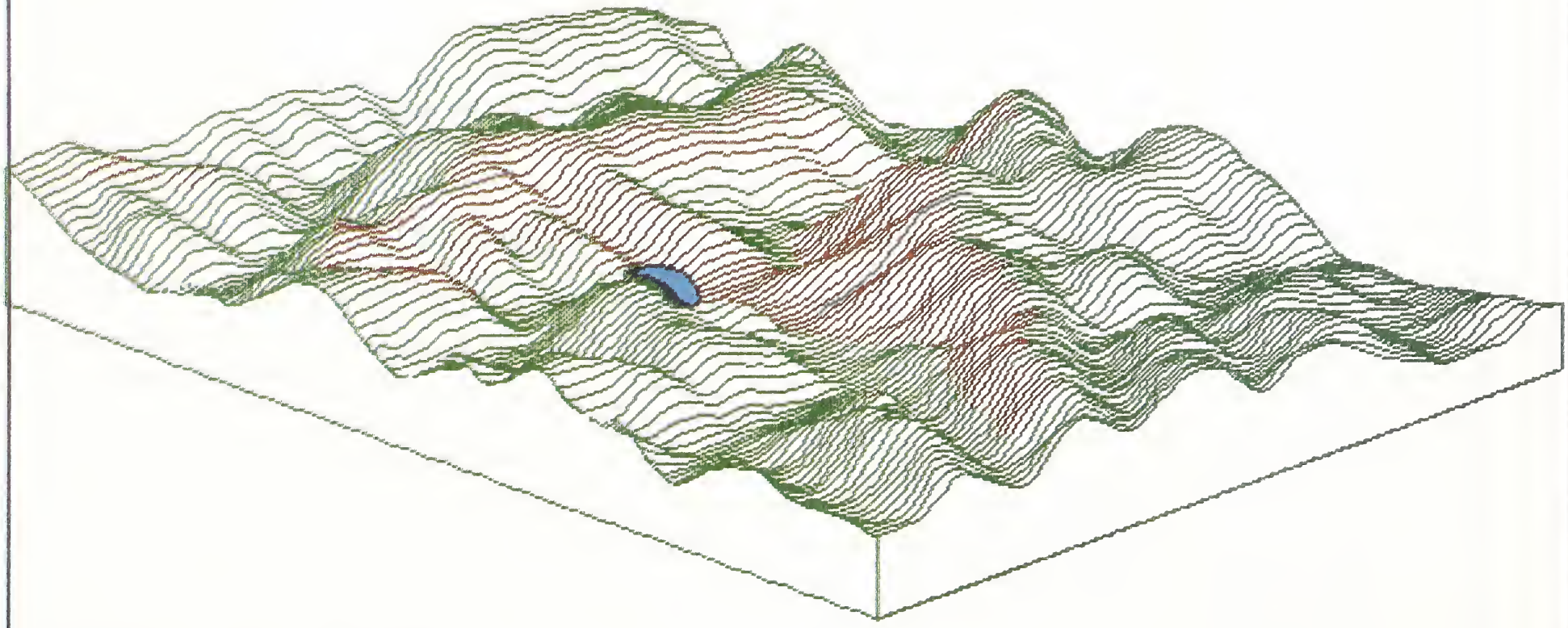
Products:

1. A three-dimensional display of those areas that can be seen from the proposed campground on the banks of Blue Lake.

PHASE 3 – EXTENSIVE RECONNAISANCE

GIS TECHNIQUE: DRAPING

3 DIMENSIONAL DISPLAY



SEEN AREA FROM

PROPOSED CAMPGROUND

AT BLUE LAKE

PHASE 4 - PREPARE FEASIBILITY REPORT

Narrative:

In this phase, the IDT established tentative alternatives for this project based on the themes and criteria identified in Phase 2. In doing this, the team first made a map which displayed the land areas which were known to have wildlife, soil, visual quality or other resource considerations. Finally, they consolidated these maps for the line officer (see Product 1 below) to use in deciding on the feasibility of this proposal. Other maps and tables were made for the line officer, such as a preliminary transportation/ harvest plan, but were not included in this case study.

The feasibility of this proposal was examined in three different areas: technical, social and economic. The line officer decided that the project was feasible. However, it was clear from the product shown below that a careful integration of resource needs would be needed throughout the development of the proposal.

Products:

1. Composite map of harvest exclusions, harvest restrictions, treatment priorities, and remaining treatment needs with corresponding acreages. The GIS generated table also shows the amount of acreage by priority with no harvest and restricted harvest limitations.

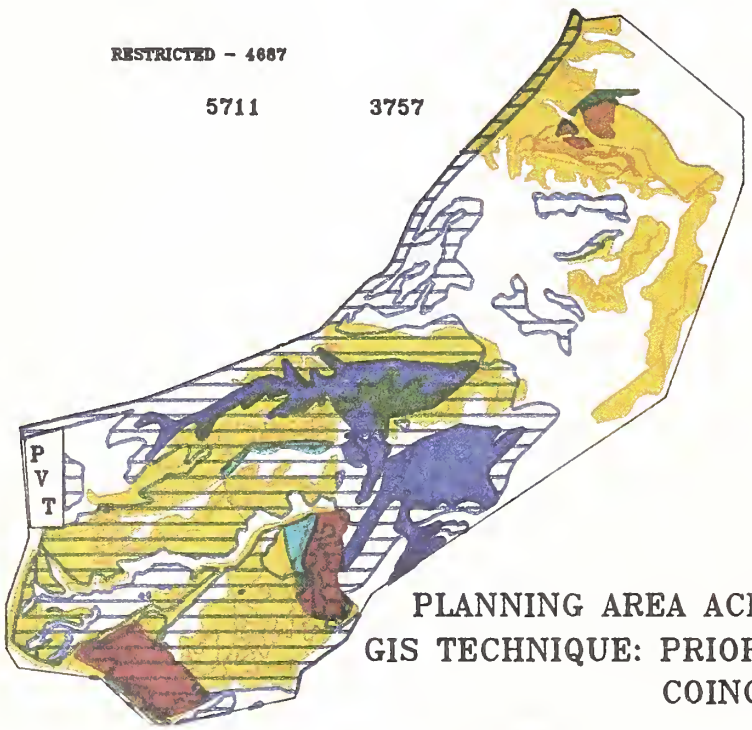
PHASE 4 – PROJECT FEASIBILITY
(TREATMENT NEEDS LESS POTENTIAL LIMITATIONS)

COINCIDENCE TABLE

TREATMENT NEEDS W/O RESTRICTIONS	HARVEST RESTRICTIONS	REMAINING AREA W/O RESTRICTIONS
PR.1 – 64		
PR.2 – 47	NO HARVEST – 1024	
PR.3 – 31		
REST – 1362	RESTRICTED – 4687	
TOTAL: 1504	5711	3757

MAP LEGEND

- PRIORITY ONE
- PRIORITY TWO
- PRIORITY THREE
- REMAINING TREATMENT NEEDS
- NO HARVEST
- HARVEST RESTRICTIONS



PLANNING AREA ACRES = 10972

GIS TECHNIQUE: PRIORITIZATION COINCIDENCE

SCALE 1: 104000.

AUTOGIS

2/12/91 15:25:27

PHASE 5 - CHECK BUDGET LINK

Narrative:

The information generated through the feasibility report phase was compiled and set in a table of statistics generated by the GIS system to help in the scheduling of work and updating of the 10-year implementation schedule.

Products:

No new GIS products were generated for this phase of the case study.

PHASE 6 - CONDUCT INTENSIVE RECONNAISSANCE, SURVEY OR DESIGN

Narrative:

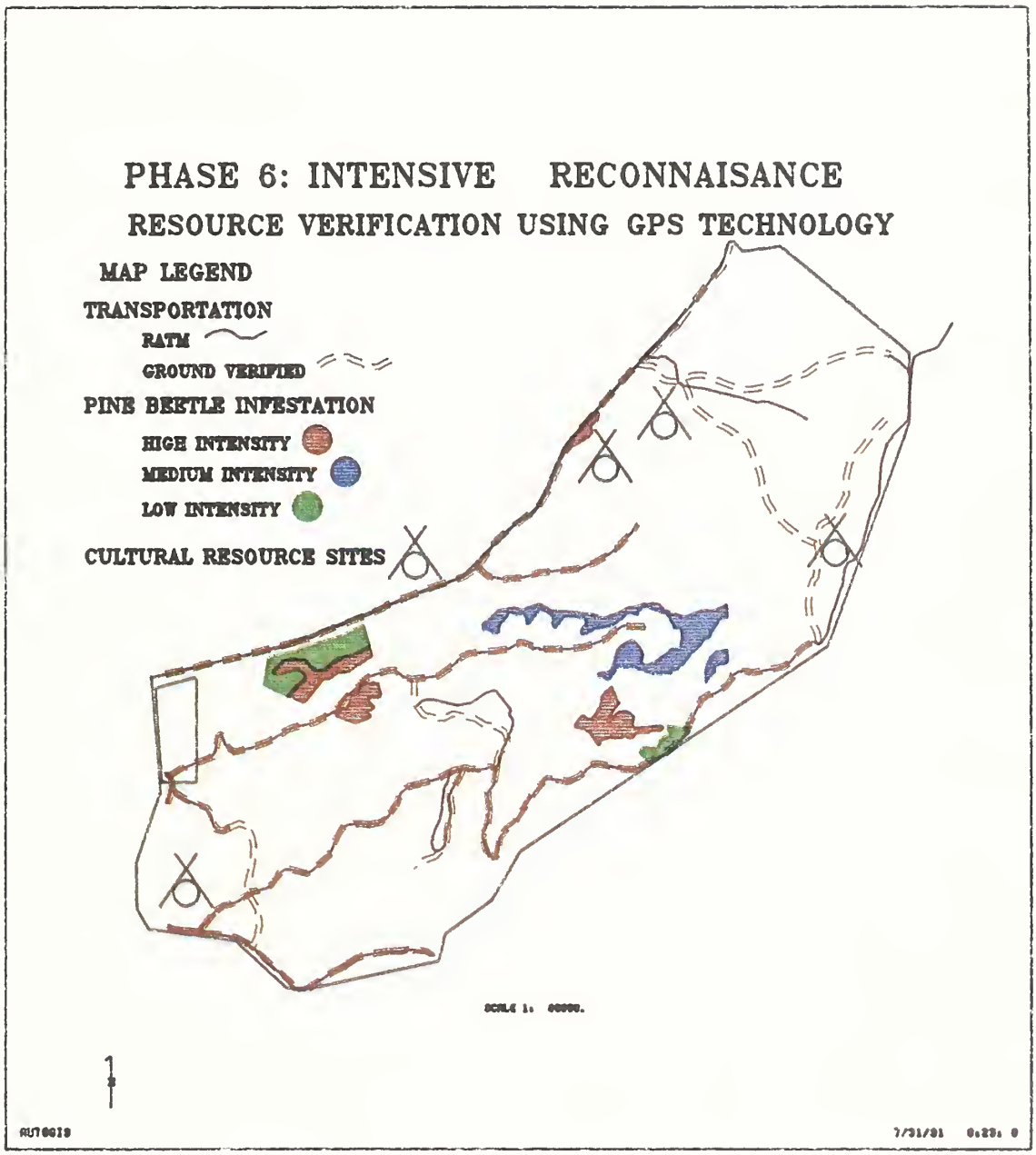
With the completion of the intensive reconnaissance, all information relevant to this analysis is accomplished to the level specified in the Information Needs Assessment (INA). The information relates directly to the alternative formulation criteria and alternative evaluation criteria that had been specified in earlier phases. This case study only scratches the surface of the potential uses of this information.

The products shown below display only a *small portion* of the detailed information gathered during intensive reconnaissance. Road information, pine beetle infestation intensity and cultural resource sites are shown on Product 1.

All new data and locational information is incorporated into GIS and the Integrated Data base.

Products:

1. Map of cultural resource sites, roads, intensities of pine beetle infestations, located using Global Positioning System (GPS) technology.


PHASE 6: INTENSIVE RECONNAISANCE
RESOURCE VERIFICATION USING GPS TECHNOLOGY
MAP LEGEND
TRANSPORTATION
RATM
GROUND VERIFIED
PINE BEETLE INFESTATION
HIGH INTENSITY
MEDIUM INTENSITY
LOW INTENSITY
CULTURAL RESOURCE SITES
SCALE 1:
AUTOCAD
7/31/01

PHASE 7 - FINALIZE AND COMPARE ALTERNATIVES

Narrative:

Phase 7 is where GIS technology may prove most valuable. In selecting products for this phase the team felt it was most important to produce products that displayed how GIS can be used to formulate alternatives. With this technology it should be easy for us to generate a full array of viable alternatives. The alternative formulation criteria assured acceptable levels of integration for all resources. Within that context, varying degrees of issue resolution were accomplished for each alternative theme. All alternatives considered in detail, in this example, were consistent with the Forest Plan and project objectives for every resource.

Products:

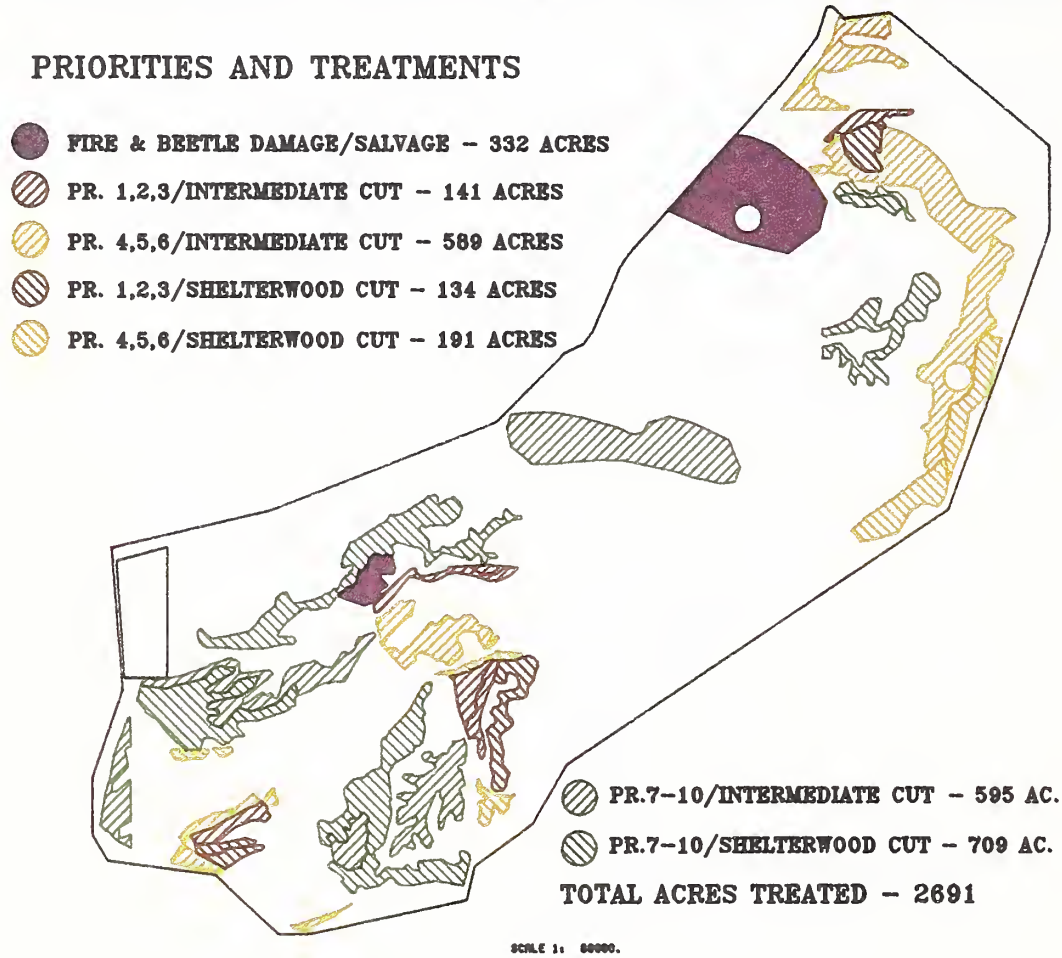
1. Maps and tables of two of the detailed alternatives that were formulated within the alternative formulation parameters. These alternatives do not show all aspects of the proposal. Transportation systems, cultural resource sites and post harvest activities such as site preparation and erosion control work are not shown to keep the display from becoming too cluttered.

PHASE 7: ALTERNATIVE 1

ALTERNATIVE GENERATED WITH FORMULATION CRITERIA

PHASE 7: ALTERNATIVE 2

ALTERNATIVE GENERATED WITH FORMULATION CRITERIA



PHASE 8 - SELECT PROPOSED ACTION

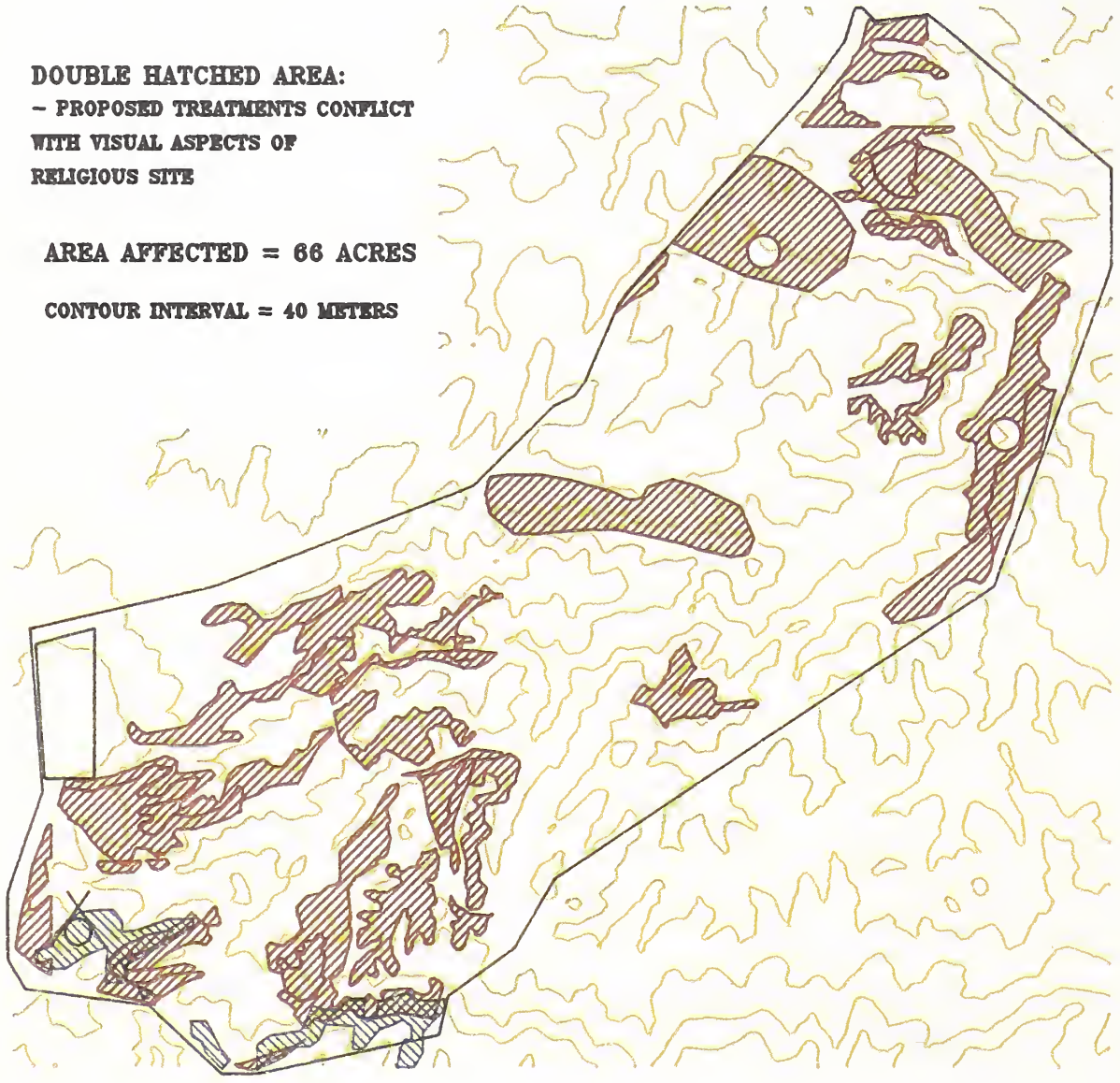
Narrative:

At the beginning of this phase, the District Ranger was presented with a full range of alternatives along with the criteria to evaluate the alternatives. At this point, a new issue surfaced. GIS technology allows for rapid analysis of new information. In this example, it was discovered that one of the cultural sites had considerable religious significance to Navajo Indians. The District Ranger recommended the IDT to exclude from analysis any portion of the project timber sale proposal that could be viewed from this site to evaluate the effects to the proposal. The IDT went back to the GIS, generated a viewshed around this particular site, and excluded it from the proposal in several alternatives. Tables and charts associated with this change were also revised. The decision of how to treat the project area went through the NEPA process, and the preferred alternative is depicted in Product 1.

Products:

1. Map of visual area surrounding a cultural resource site with religious significance and the resultant new alternative.

PHASE 8: IMPACT OF RELIGIOUS SITE ON PROPOSAL



PHASE 9 - PREPARE NEPA DOCUMENTATION

Narrative:

You will likely discover that many of the products that are developed during the analysis are of use in your environmental documentation. Certainly, most products are worth retaining in your project file folder for a variety of potential future uses. In this case study we described and produced one product (1, below) that was completed in Phase 7 but that was not shown at that time, and we describe another product (2, below) that is not reproduced here because of space limitations.

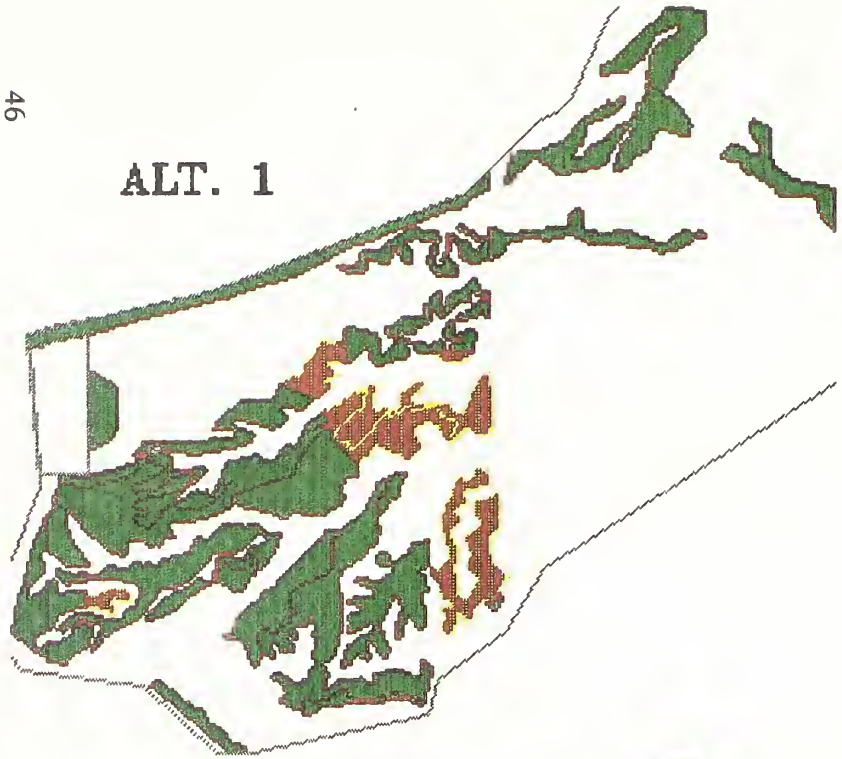
1. A side by side visual and tabular comparison of two alternatives (which were generated using alternative formulation criteria) as they relate to the issue of residual potential or existing old growth. Similar products could/should be generated for each relevant issue.

2. The private landowner was concerned about the visual effects of the proposal. A three dimensional representation of the proposal could be made that illustrates those areas that are being proposed for harvest and seen from the private property. The representation could be made over several time periods to demonstrate how the view would change over time.

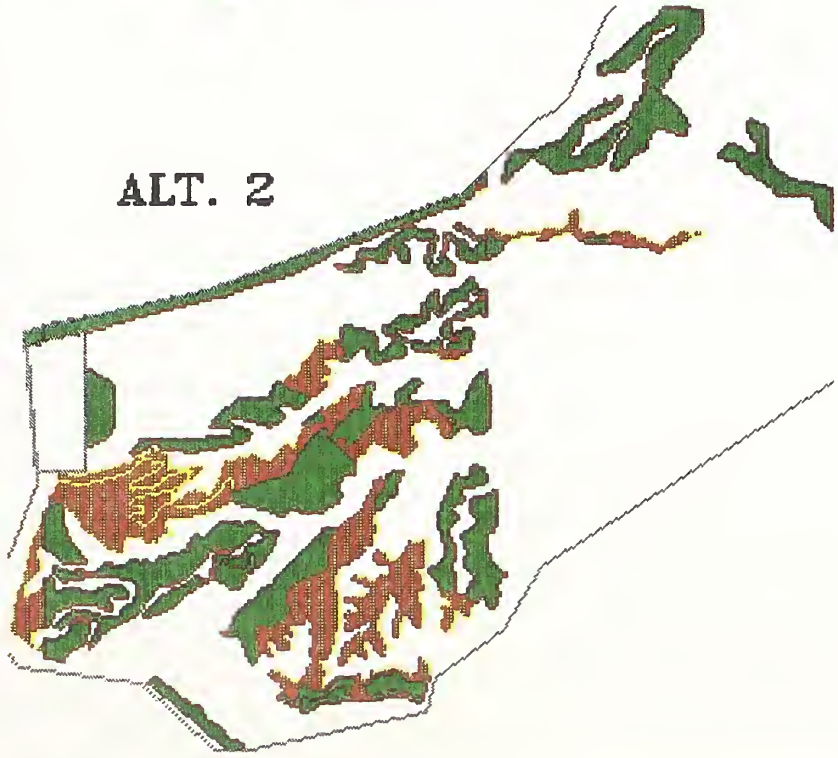
Products:

1. A one page display showing the differences between two alternatives as they relate to the issue of residual old growth or potential old growth after vegetative treatments are complete.

ALT. 1



ALT. 2



PHASE 9: ALTERNATIVE EFFECTS ON OLD GROWTH

COMPARISON TABLE

	ALT. 1	ALT. 2
ACRES O.G. TREATED	346	803
RESIDUAL O.G. ACRES	1852	1395
RESIDUAL PERCENTAGE OF OLD GROWTH	16.9	12.7

LEGEND

GREEN = RESIDUAL OLD GROWTH

ORANGE = OLD GROWTH TREATED

PHASE 10 - CHECK PROJECT RECORD

Narrative:

During this phase of the project the project team incorporated new information gathered in the previous phases into the existing set of data files. This was done to make sure that the project packet produced during this phase was up-to-date and complete.

The team was also concerned with the issue of storage space on the GIS system. The team reviewed all the current data files residing on the system and decided which ones needed to be deleted or saved to tape. The working files were saved on their own separate tape so that a complete set of files was in one location. Any files that could be combined with the existing forest data bases was copied and prepared for integration. This was done for the purpose of future forest planning.

Products:

No new products were generated for this phase.

PHASE 11 - PREPARE PROJECT ACTION PLAN

Narrative:

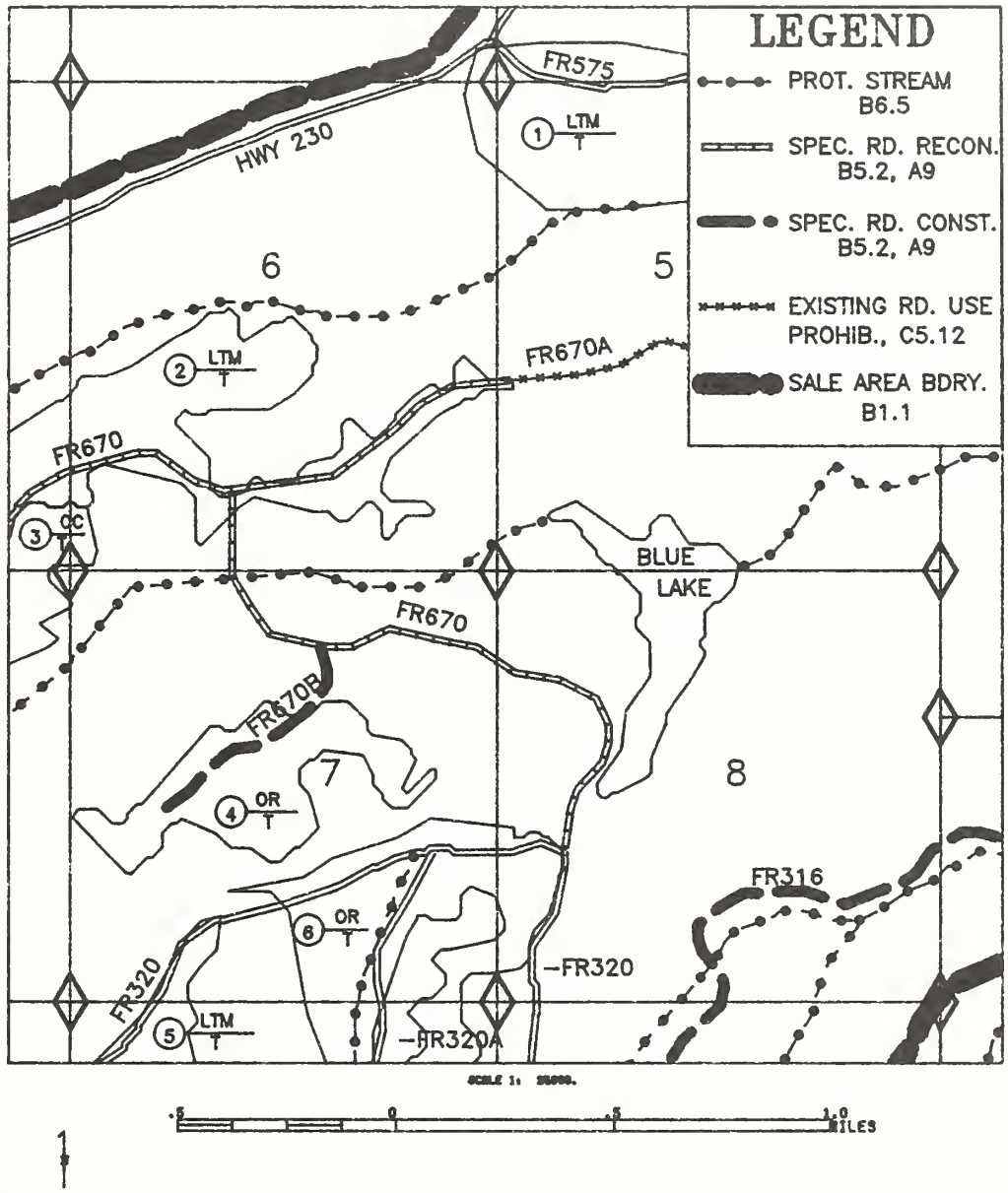
With the environmental document completed, the appropriate decision document signed, and the public properly notified of the pending action, the project is ready to be laid out on the ground and executed. The IDT determined specifically what needed to be done. They utilized maps generated through GIS to portray many of the specific directions to be given the layout crews. The crews used these maps both as direction and as a reporting system back to the ID Team. They indicated on the maps exactly where the layout actually occurred, any problems needing to be addressed, and changes from what was proposed. Using this information the IDT can make necessary changes or take other appropriate action. No products were made to display these activities.

The IDT used this final information to create the sale area and other maps required for the timber sale contract. The product below demonstrates how GIS was used to build a Timber Sale Contract map.

Products:

1. Timber Sale Contract Map

PHASE 11: SALE AREA MAP AND LEGEND (SAMPLE)



PHASE 12: IMPLEMENT PROJECT

Narrative:

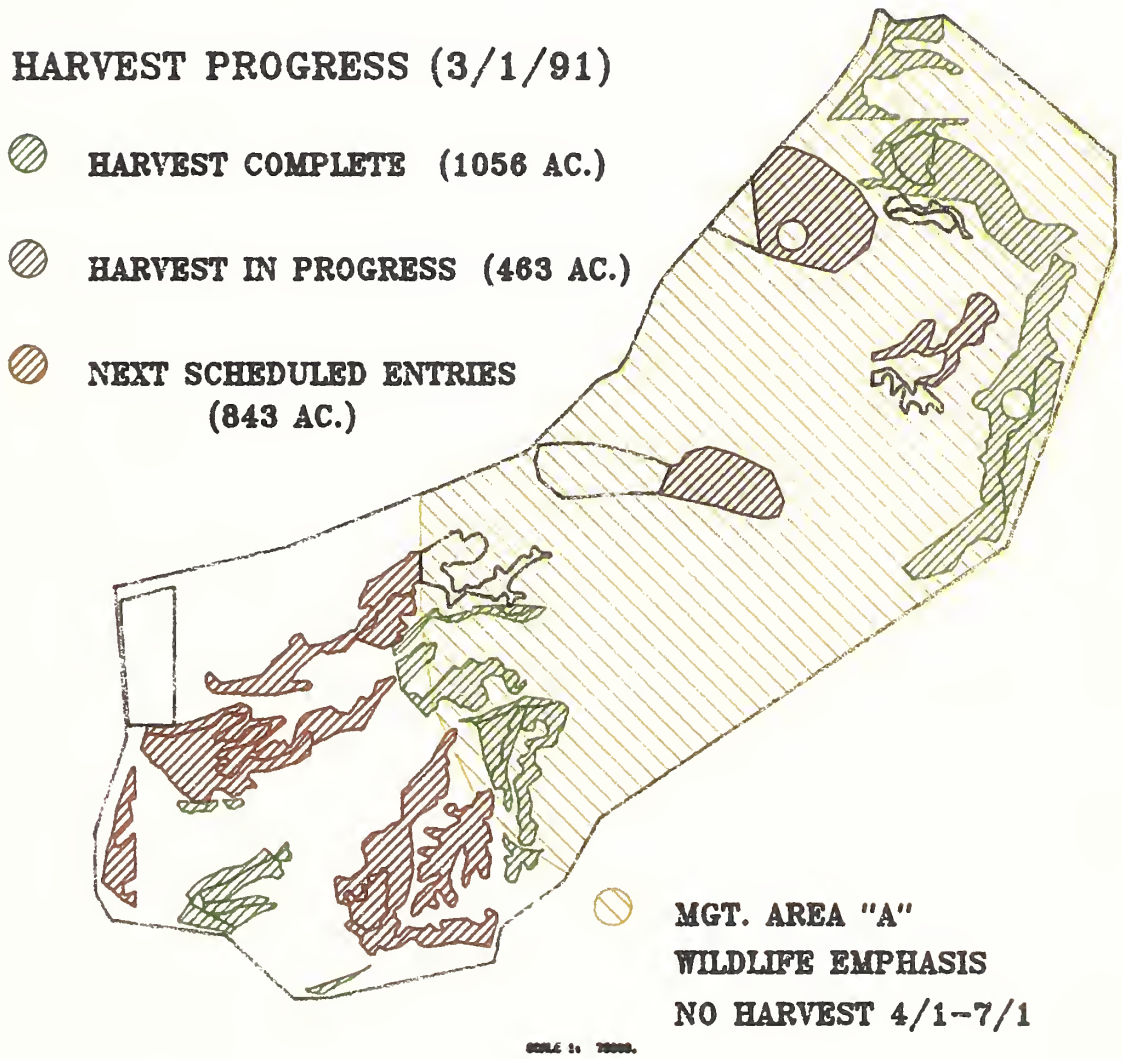
The sale administrator continued to use the contract map generated by the GIS to help with sale administration in several areas. By attaching appropriate volume per acre figures to the cutting units it is possible to query the GIS for information needed in the monthly cutting reports. The administrator can also use GIS to keep an ongoing record of sale activity and completion of contract requirements (see Product 1).

Here is a hypothetical example (no product display made) of another kind of use: During the administration of this contract the sale administrator discovered an area that is felt to have very sensitive soils. This area had not been identified before. IDT members consulted with the soil scientist, who agreed that there were sensitive soils not discovered in the project planning. As a result, the timber sale officer instructed the sale administrator to develop a detailed logging plan for the area to minimize soil disturbance and impact when the logging began. Using the GIS they were able to develop and compare several alternative harvest plans. The District Ranger picked the best one and the Timber Sale Officer presented it to the purchaser for agreement and implementation.

Products:

1. Display of progress of cutting units (already cut, in progress, and for future entry); also areas of restriction by different time periods.

PHASE 12: IMPLEMENTATION MAP



PHASE 13. MONITOR AND EVALUATE RESULTS

Narrative:

In this case study we used a GIS system capable of being linked to any of several predictive modeling programs. This linkage was made during the planning of the project. The predictive modeling results are displayed below. The task now is to monitor the effects which actually result from putting the project on the ground, and compare the *actual results* with the *predicted results*. One such result, in this case study, is the effect on water quality of past, current and proposed future actions (*Cumulative Effects Monitoring)* within the Deer Creek watershed. In this example we monitored only water quality (turbidity). Actual and predicted effects of sedimentation delivery were measured at selected points. Our predictive model expresses the effect in *Nephelometric Turbidity Units*. According to our predictive modeling the total effect to water quality, if the future project is implemented as planned, will exceed the acceptable standards (see product below).

Products:

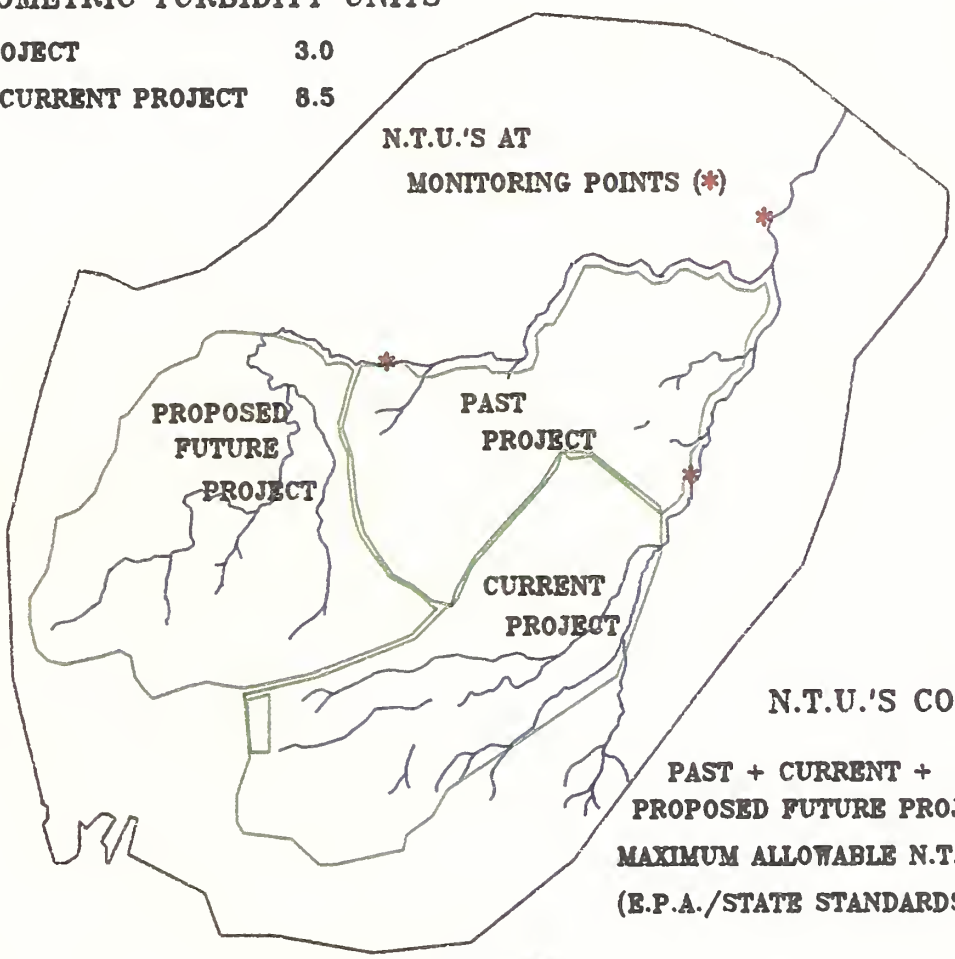
1. Cumulative effects monitoring and analysis of water quality, completed by measuring the actual effects of past and present activities at specific points within the Deer Creek watershed. Future proposals may be adjusted as a result of this monitoring.

PHASE 13: WATER QUALITY MONITORING

(PROJECT CUMULATIVE EFFECTS)

NEPHELOMETRIC TURBIDITY UNITS

PAST PROJECT	3.0
PAST & CURRENT PROJECT	8.5



SCALE 1: 100000.

N.T.U.'S CONTINUED

PAST + CURRENT + PROPOSED FUTURE PROJECTS	13.0
MAXIMUM ALLOWABLE N.T.U.'S (E.P.A./STATE STANDARDS)	10.0

APPENDIX B - ALTERNATIVE GENERATION

Narrative:

The "think tank" committee felt so strongly about using GIS in alternative formulation that we have dedicated this appendix to discussing this subject. One of the constant battles that line officers and Interdisciplinary Team (IDT) members encounter in developing project proposals is displaying a wide and viable range of alternatives. Just from the cutting unit standpoint there is an infinite number of alternatives that could be developed. Cutting unit size, number, shape, spatial arrangement, silvicultural treatment method and post harvest site preparation are just a few variables that exist for every stand being considered, and we haven't even begun to discuss transportation system variables, road closures, wildlife improvements or mitigation measures. It is ridiculous for us to say "there are only three alternatives: No action, an integrated proposal and full steam ahead".

So how then can we go about formulating a "reasonable" range of alternatives? One way is to quantify, or otherwise clearly explain, a minimum acceptable standard degree of issue resolution for all resources relevant to your analysis. With these standards set, each alternative can be formulated specifically within those IDT agreed-to standards. Depending upon the "theme" of a particular alternative you can either exceed, in a positive sense, the minimum standard, or, in some cases, barely meet the agreed-to standard for a particular resource. Many of these standards are set for us in the Forest Plans (see example on facing page); others can be developed by the IDT specifically for a particular project. The "think tank" committee called these standards "alternative formulation criteria".

It does take work. Formulating an alternative, is a step by step process which requires the generation of one or more interim GIS products at each step. We have included *many* (not all) of the interim products that were generated in arriving at Alternative 2, which is shown in Phase 7 of Appendix A. Two examples of the issue by issue formulation are included in the assembly of this product. Those issues are old growth and visual quality objectives associated with retention zones.

The key to the alternative formulation, on an issue by issue basis, is to locate where your priority treatment needs coincide and possibly conflict with the needs of each other important resource issue. It is in these places that we can both make sure we meet acceptable standards and through IDT interaction vary the proposal significantly by issue and alternative.

Each of the maps in this appendix are numbered "Ph.7 Product Development (1), Ph. 7 Product Development (2)," etc. The following narratives briefly explain the sequence of events that occurred in formulating Alternative 2 in Phase 7, and are to be used in conjunction with Appendix B maps:

(1) The first step of any product formulation is to enter fixed things such as ownership, planning boundaries, management area boundaries, lakes, etc., that are relevant to the analysis and product formulation.

(2) The next four maps look at the opportunities or problems for management action associated with the vegetation within this planning area. The map displays the stand boundaries that were finalized *during intensive reconnaissance*. Data relevant to each stand is also available to the GIS user.

(3) The Interdisciplinary Team (IDT) developed a scheme of priorities for treatment based on the issues of: low forage, mistletoe infestation and potential to produce house logs. The GIS was queried to map all areas that fell within priorities 1 through 3.

(4) The priority scheme set by the IDT is continued. Priorities 1 through 6 are displayed.

(5) This map displays the culmination of this sequence. All opportunity or problem areas identified by the IDT within the Vegetation Component of the planning area are displayed. No priority for treatment exists within any stand not shaded.

(6) The next three mapping steps display other resource needs and objectives that may cause an IDT to modify the kinds and amounts of silvicultural treatments to consider. The map displays spotted owl core territories and cultural resource sites where no harvest is allowed in order to protect these valuable resources.

(7) This map begins to display other resource objectives called for in the Forest Plan. Spotted Owl foraging territories and needed structural diversity associated with potential or existing old growth stands are shown.

(8) Finally, resource needs associated with sensitive soils and visual quality are displayed. Remember, these are only examples. Your analysis area may call for an examination of more (or less) resource needs.

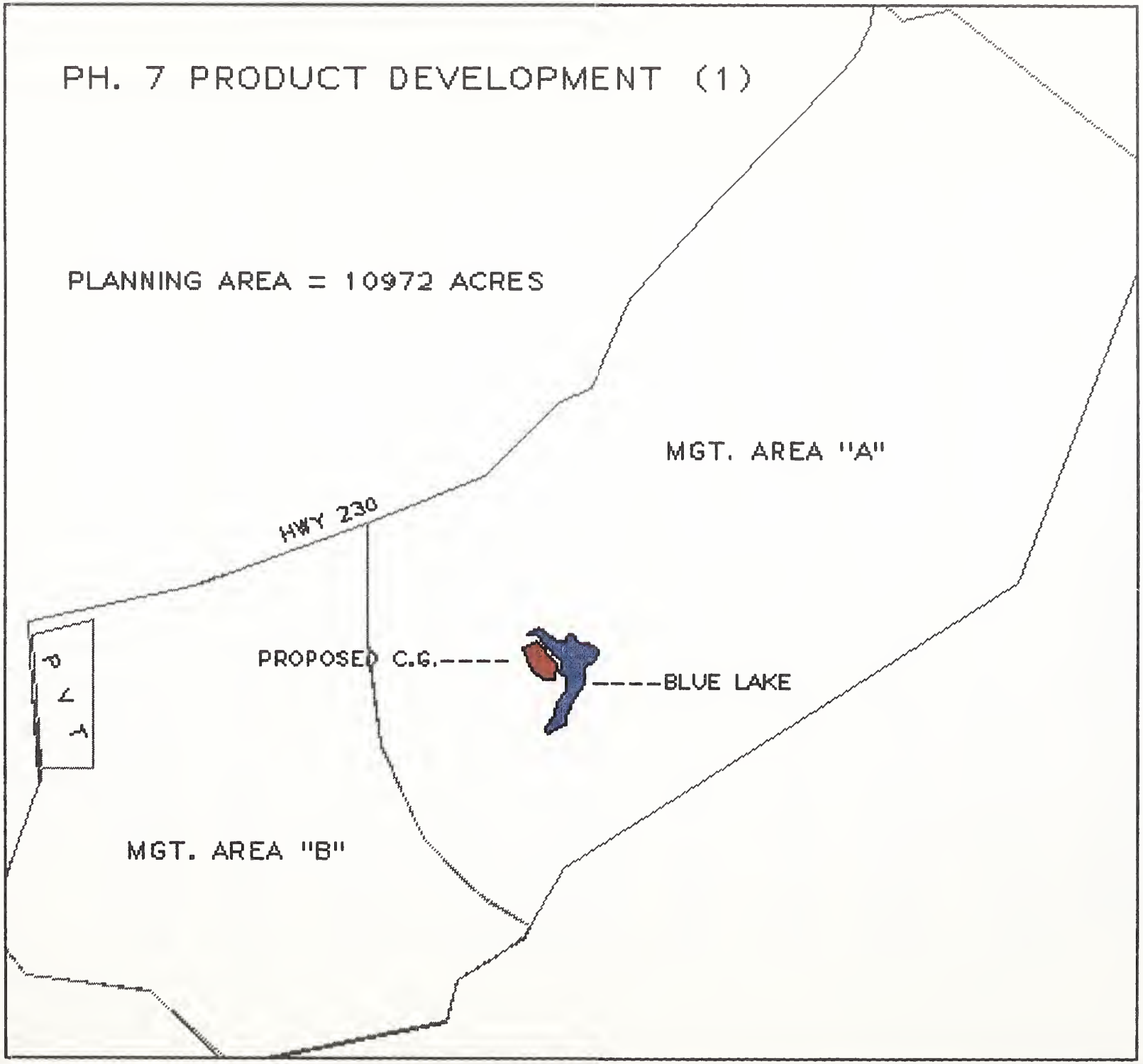
(9) Each issue must now be examined in relation to the harvest priorities and limitations. For the sake of this exercise we have chosen two of these issues to compare with the priority treatment needs. The first one shows the area where the priority needs for harvest overlap with areas identified as potential or existing old growth. The second is in relation to the standards called for in the Forest Plan for harvesting within visual quality retention objective zones (see next page). The overlapping areas may be selected for treatment provided that the standards, guidelines and objectives of the LMP end project plans are met. This can be easily accomplished by querying the GIS.

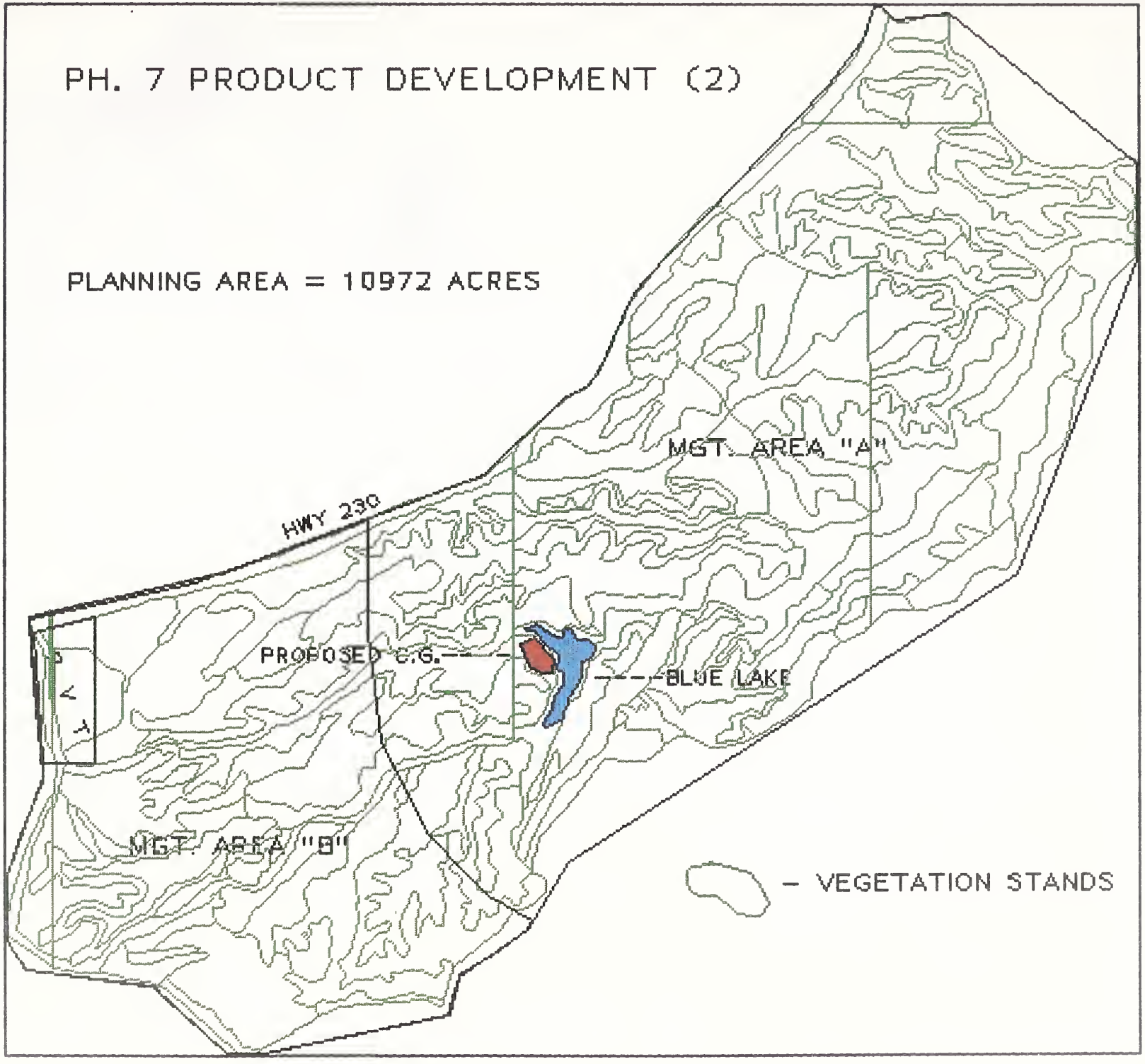
(10) This map depicts a 3D view of the overlap between the retention zones of the seen area from the proposed campground and those stands having priority treatment needs. Stands can be selected for this alternative from within the retention zone provided they meet the planning standards.

Phase 7: Alternative 2: This map displays all of the stands selected to formulate this alternative. Combined, these proposed harvest units meet or exceed all objectives established by the IDT and Forest Plan.

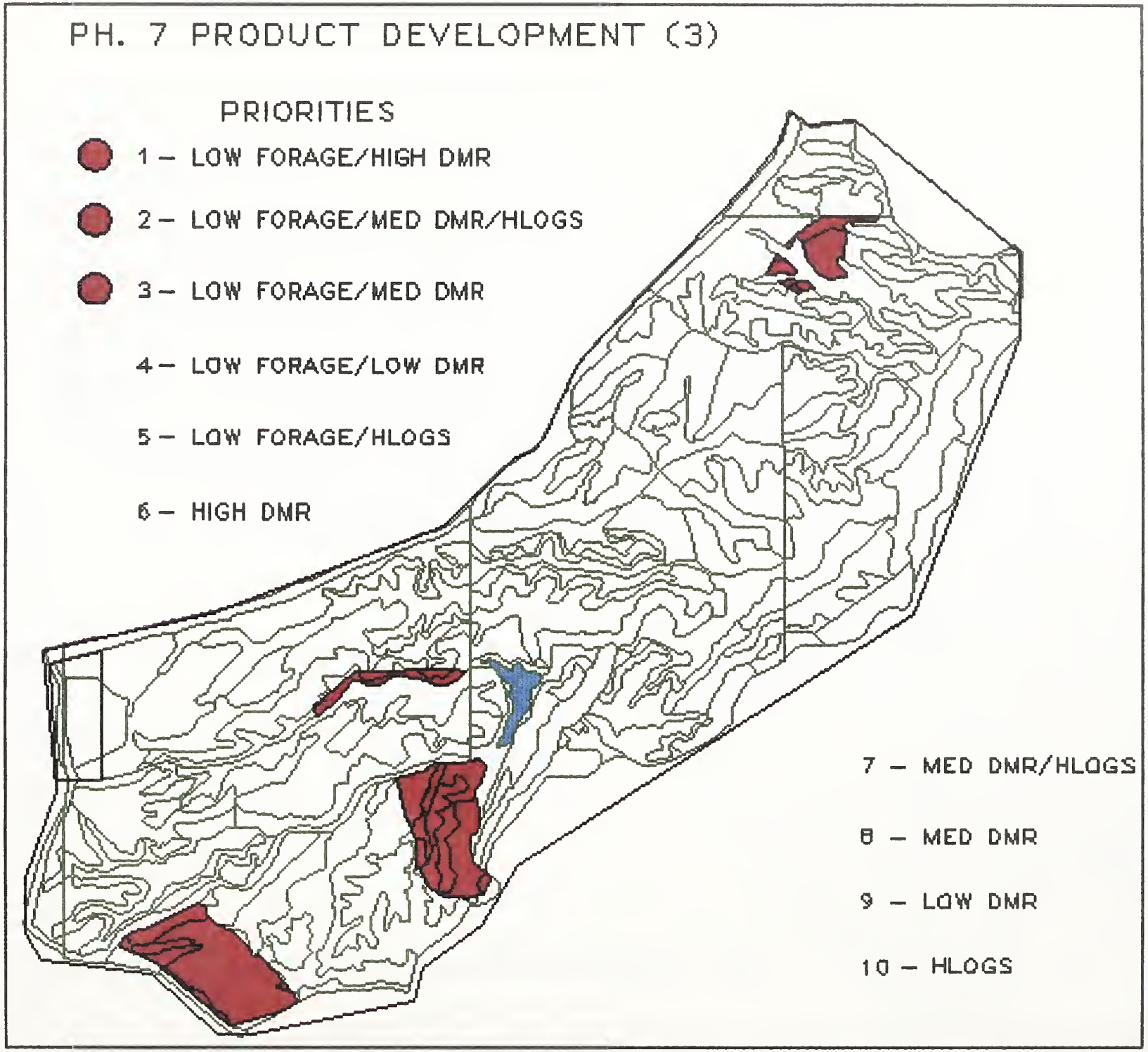
Spiking: The last two products exhibit two very important traits needed for todays natural resource manager using GIS for project analysis. The first trait is to be patient and persistent. Things like "spiking" (hardware or software shortcomings), miscommunications and interruptions will occur and slow progress. Be patient, stick with it.

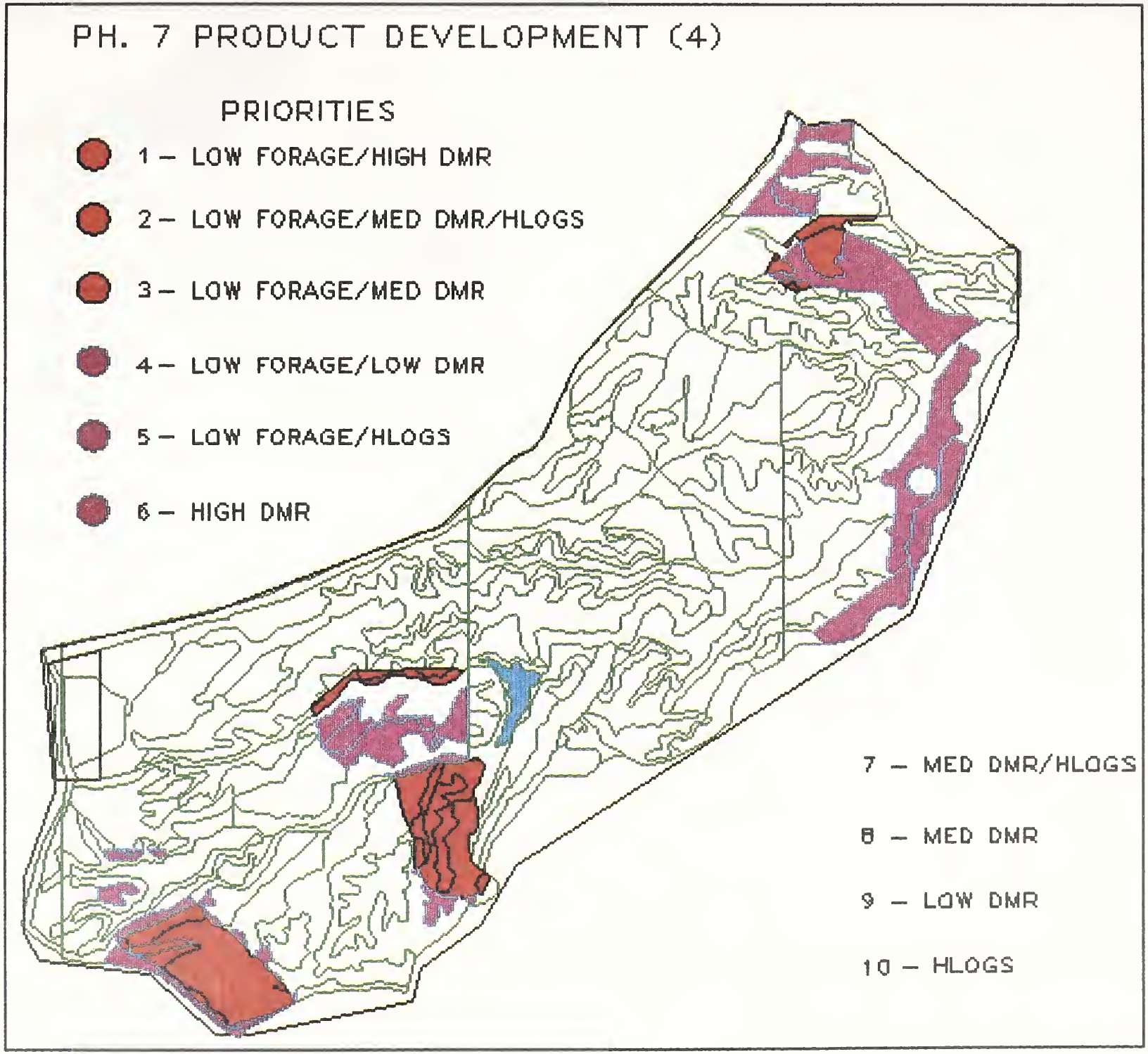
Organization: This display shows a partial list of the names of the 186 maps that were generated during this analysis as interim or final products. The task of naming and tracking these products requires considerable organizational effort in order to find and retrieve needed information. Be thinking about this task from the beginning of your analysis.

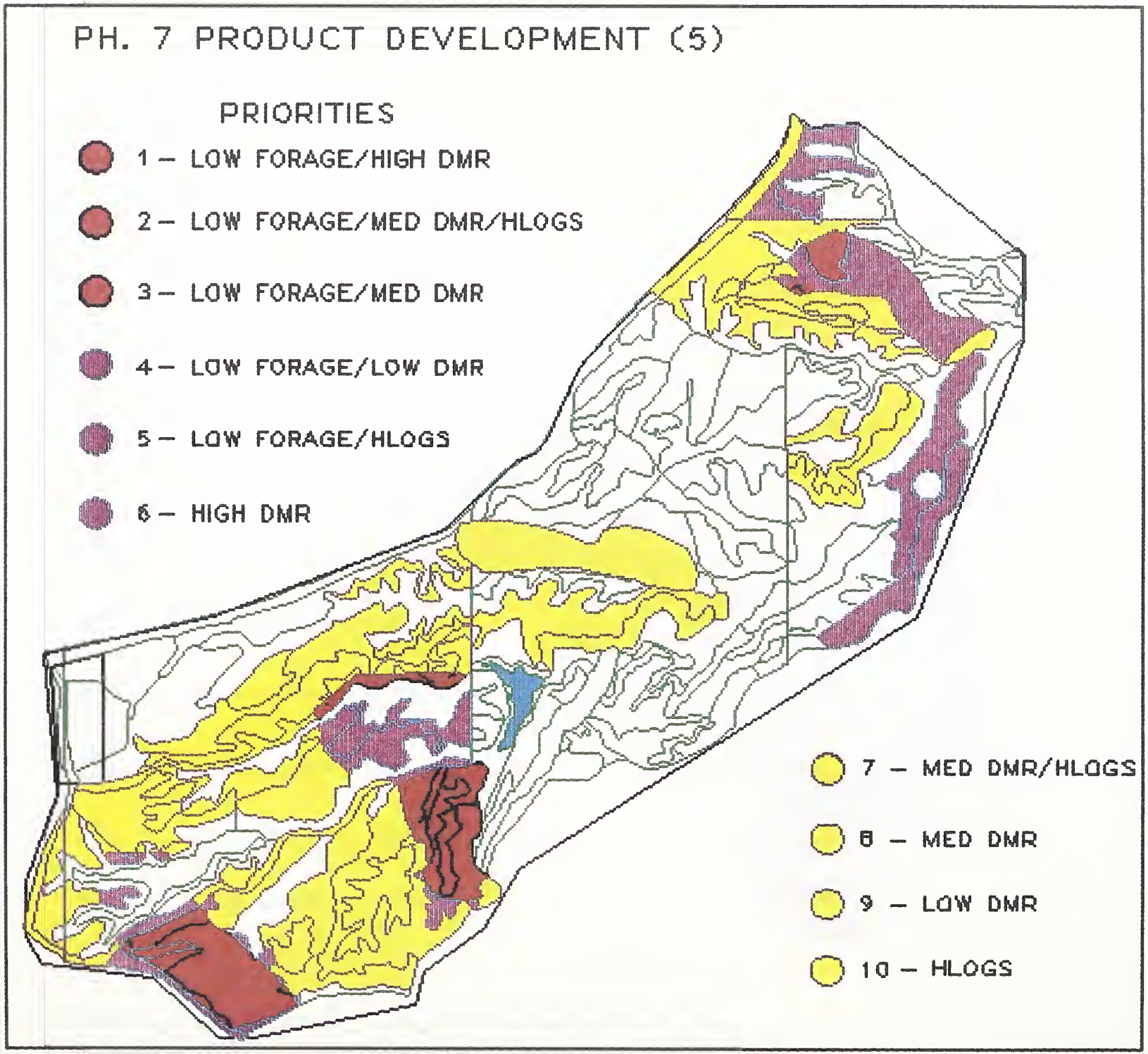

PH. 7 PRODUCT DEVELOPMENT (1)
PLANNING AREA = 10972 ACRES
MGT. AREA "A"
HWY 230
PROPOSED C.G.----
----BLUE LAKE
PH 7
MGT. AREA "B"

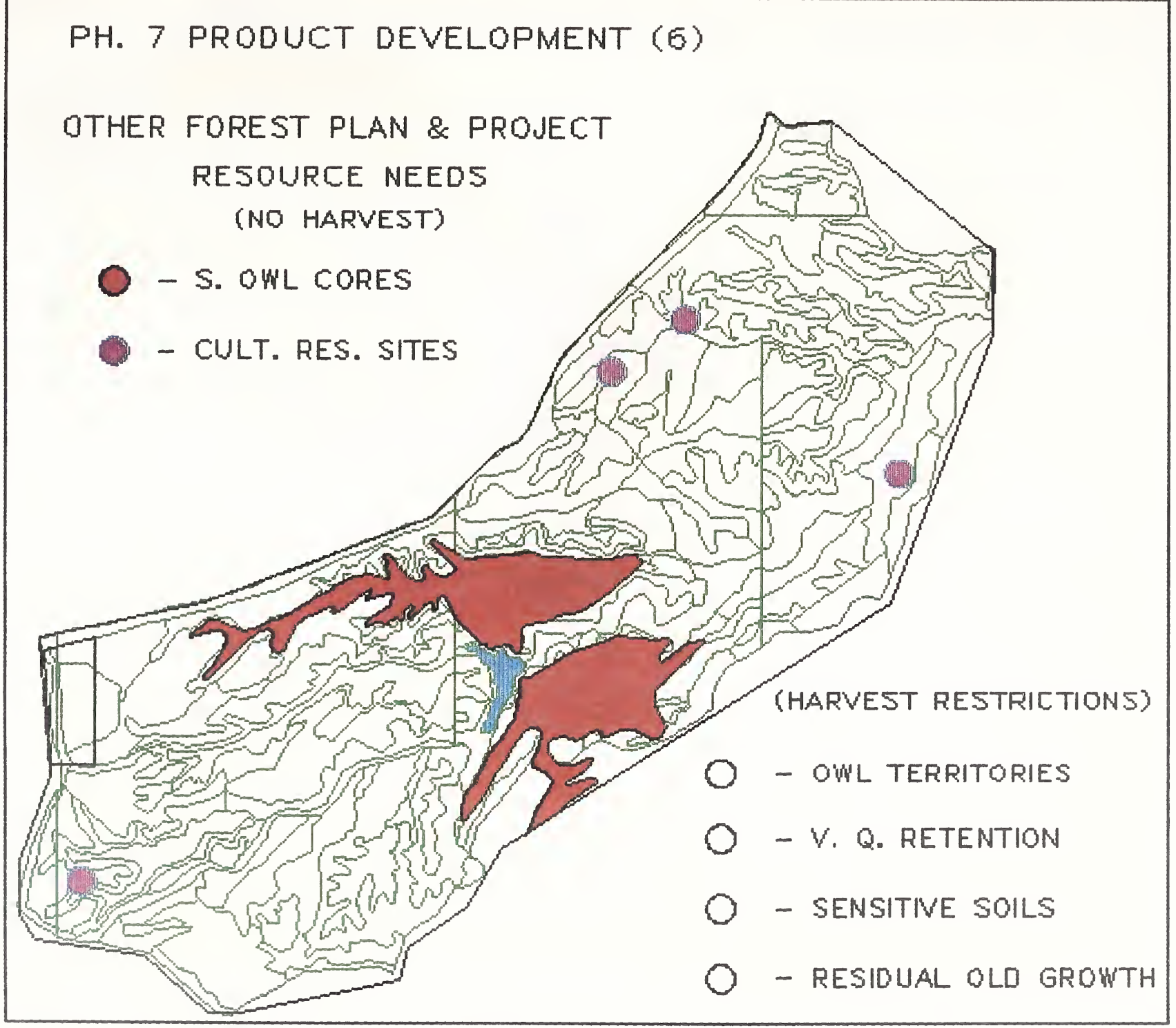

PH. 7 PRODUCT DEVELOPMENT (2)
PLANNING AREA = 10972 ACRES
MGT. AREA "A"
HWY 230
PROPOSED C.G.
BLUE LAKE
MGT. AREA "B"
- VEGETATION STANDS

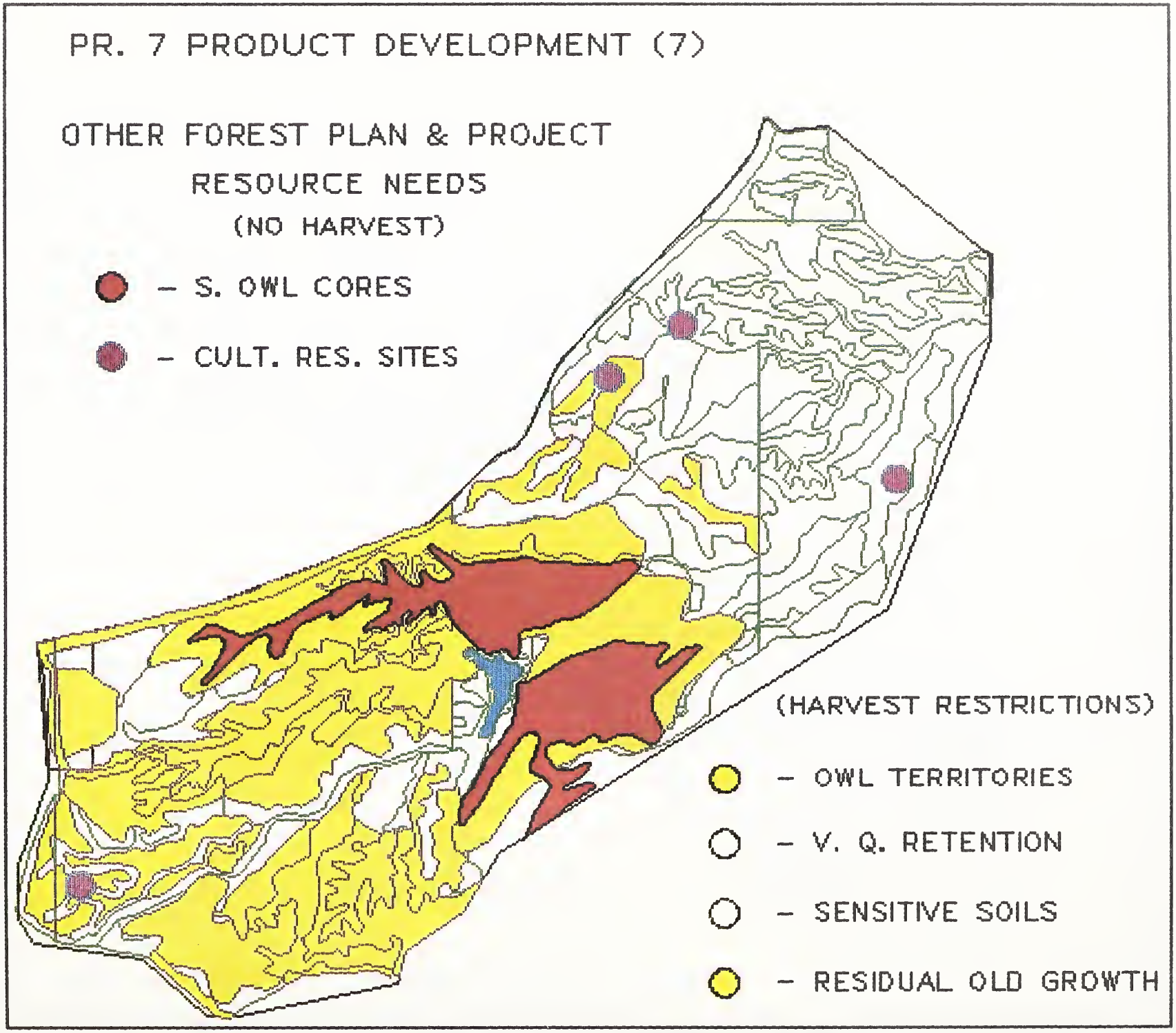
PH. 7 PRODUCT DEVELOPMENT (3)

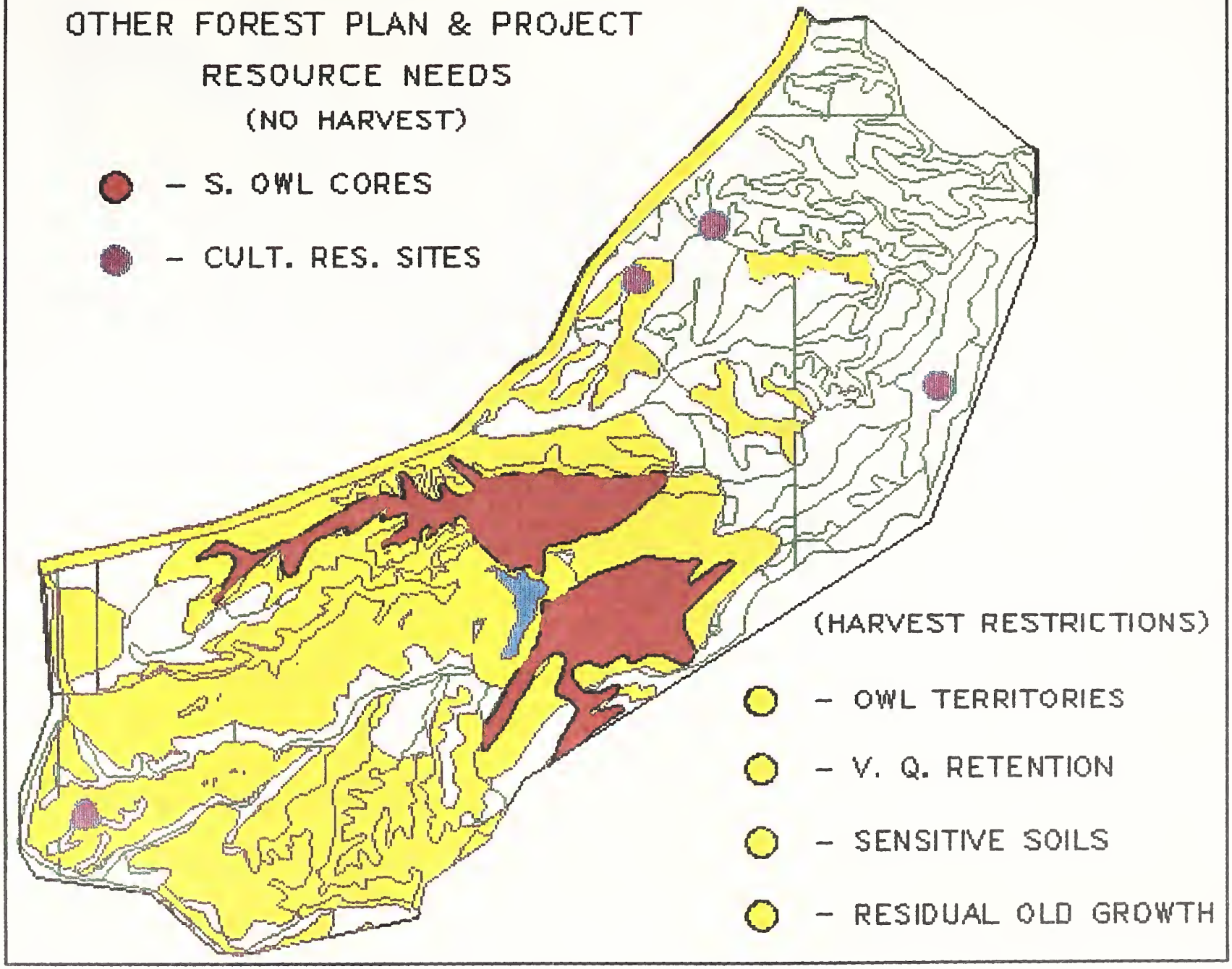



PH. 7 PRODUCT DEVELOPMENT (4)
PRIORITIES
1 – LOW FORAGE/HIGH DMR
2 – LOW FORAGE/MED DMR/HLOGS
3 – LOW FORAGE/MED DMR
4 – LOW FORAGE/LOW DMR
5 – LOW FORAGE/HLOGS
6 – HIGH DMR
7 – MED DMR/HLOGS
8 – MED DMR
9 – LOW DMR
10 – HLOGS


PH. 7 PRODUCT DEVELOPMENT (5)
PRIORITIES
1 – LOW FORAGE/HIGH DMR
2 – LOW FORAGE/MED DMR/HLOGS
3 – LOW FORAGE/MED DMR
4 – LOW FORAGE/LOW DMR
5 – LOW FORAGE/HLOGS
6 – HIGH DMR
7 – MED DMR/HLOGS
8 – MED DMR
9 – LOW DMR
10 – HLOGS


PH. 7 PRODUCT DEVELOPMENT (6)
OTHER FOREST PLAN & PROJECT
RESOURCE NEEDS
(NO HARVEST)
– S. OWL CORES
– CULT. RES. SITES
(HARVEST RESTRICTIONS)
– OWL TERRITORIES
– V. Q. RETENTION
– SENSITIVE SOILS
– RESIDUAL OLD GROWTH

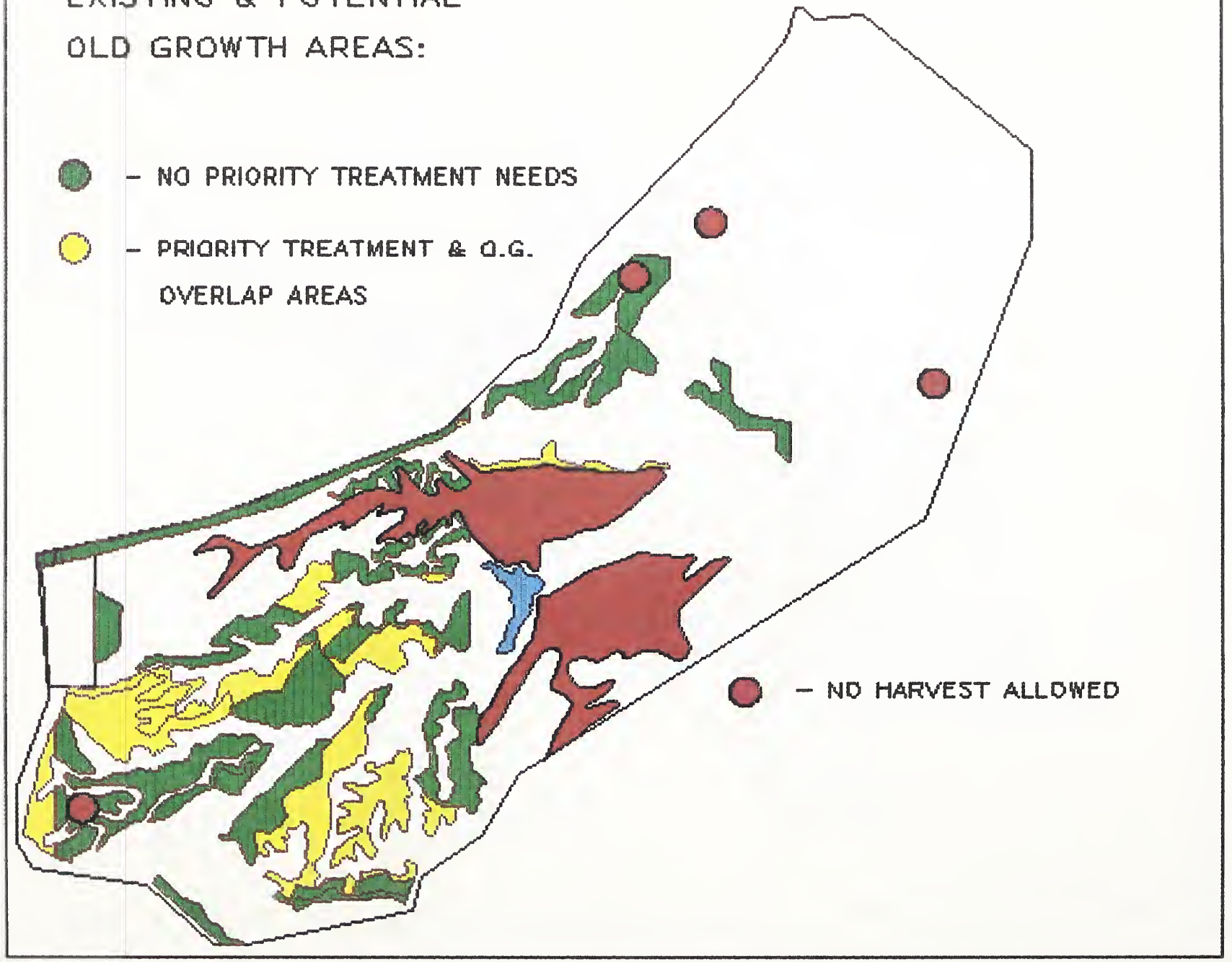

PR. 7 PRODUCT DEVELOPMENT (7)
OTHER FOREST PLAN & PROJECT
RESOURCE NEEDS
(NO HARVEST)
– S. OWL CORES
– CULT. RES. SITES
(HARVEST RESTRICTIONS)
– OWL TERRITORIES
– V. Q. RETENTION
– SENSITIVE SOILS
– RESIDUAL OLD GROWTH


PH. 7 PRODUCT DEVELOPMENT (8)
OTHER FOREST PLAN & PROJECT
RESOURCE NEEDS
(NO HARVEST)
– S. OWL CORES
– CULT. RES. SITES
(HARVEST RESTRICTIONS)
– OWL TERRITORIES
– V. Q. RETENTION
– SENSITIVE SOILS
– RESIDUAL OLD GROWTH

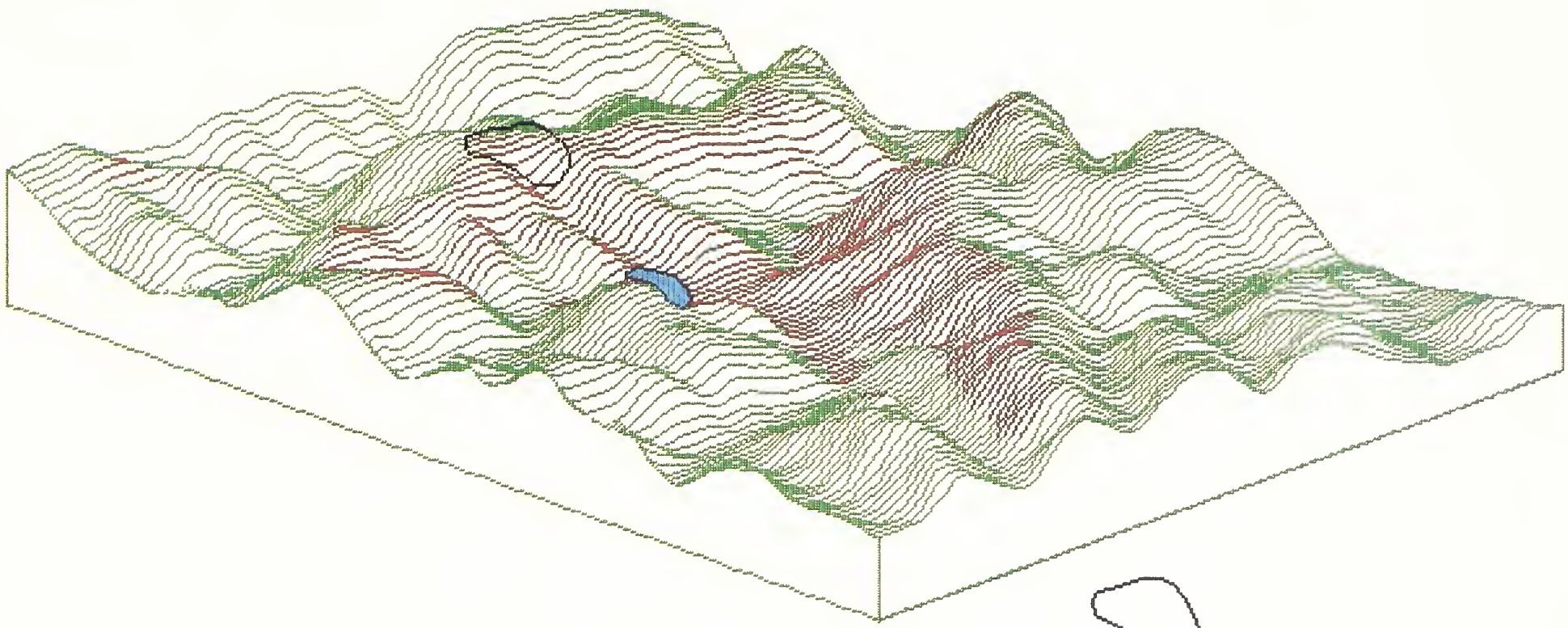
PH. 7 PRODUCT DEVELOPMENT (9)

EXISTING & POTENTIAL

OLD GROWTH AREAS:



PH. 7 PRODUCT DEVELOPMENT (10)

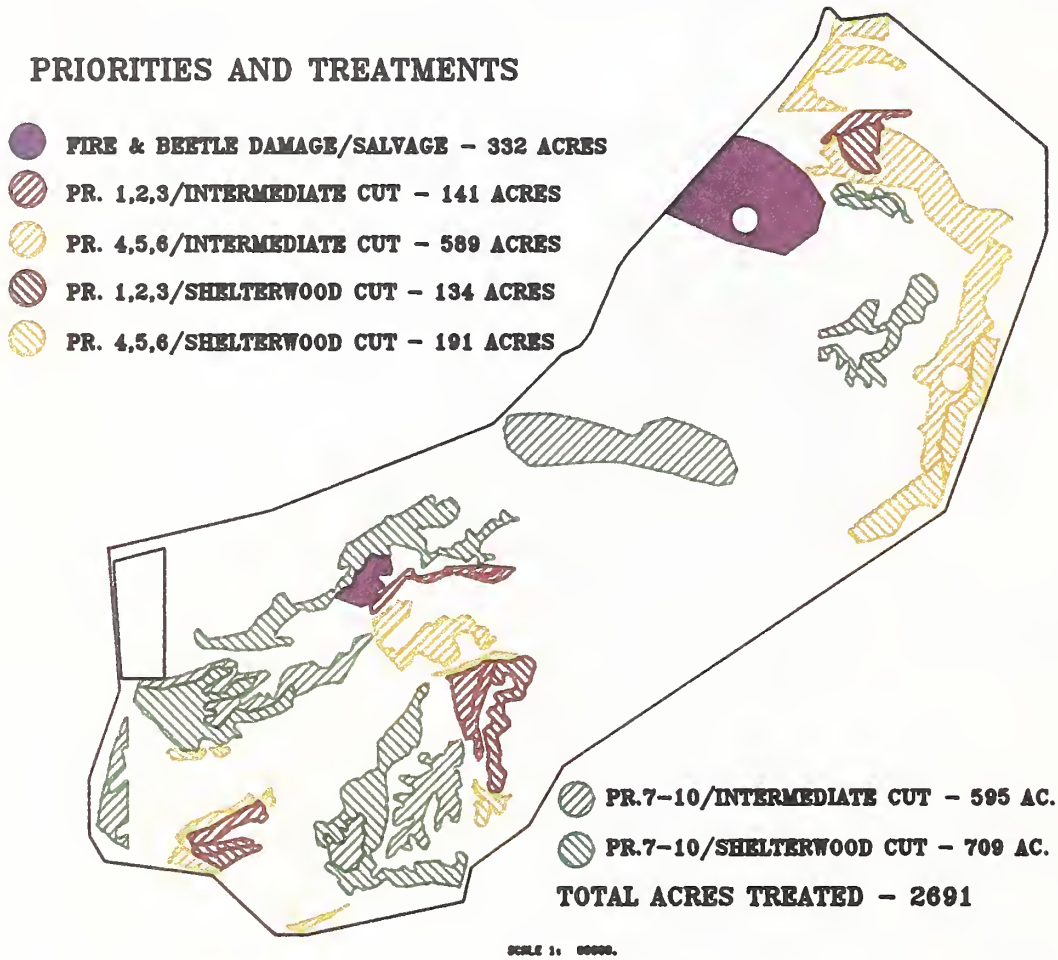


VQO RETENTION ZONE (RED)
SEEN FROM PROPOSED
CAMPGROUND AT BLUE LAKE

PRIORITY
TREATMENT
NEED

PHASE 7: ALTERNATIVE 2

ALTERNATIVE GENERATED WITH FORMULATION CRITERIA



2/18/91 17:17:18

Partial List of Maps Generated as Interim or Final Products

ENTER COMMAND? LIST WORK

281 MAPS IN WORK PROJECT POLYGON

3D.TEXT	10	ADD.YEL	3
ALT1.MOCS	3	APPB.PRIOR.TEXT	10
APPB710.STAND	3	APPB710.TEXT	10
APPB73.TEXT	10	APPB74.TEXT	10
APPB76.ARCH	3	APPB76.LEG	3
APPB76.TEXT	10	APPB77.LEG	3
APPB77.TEXT	10	APPB78.TEXT	10
APPB79.POINTS	1	APPB79.TEXT	10
ARC.SEEN.POLY	3	ARC.SITE.SEEN	8
ARCH1	1	ASNF	3
BIGTOE	3	BUF2LEG	3
CG.SEEN	8	CG.SEEN.ADD3	7
COVER.DBRY.ASS	3	COVER.BOX	3
COVER.LAK.LINE	3	COVER.TEXT	10
CU.2.L	2	CU.4.1	3
CU232SW	3	CUB	3
DEM	8	DEM210NE	8
DEM231SE	8	DEM232NW	8
DRAPE1	7	EWALL	3
FIRE.LEG	3	FOR.HSELOG	3
FRT231.NW	2	FRT232SW	2
H2O.M.BLOB	3	HAR.REST.ALL	3
HEB.EHU	3	HOLE	3
HSE.LOGS	3	IPS	3
JH.BOUND	3	JH.CONTOUR	2

Continue(y/n, newline=yes):

APPENDIX C - INFORMATION NEEDS ASSESSMENTS

Narrative:

A *project Information Needs Assessment (INA)* may need to be conducted in *three (3) levels of intensity and/or reliability.* The *first level* would be to gather all readily available existing information from Forest Plans and any other information source to be used in the development of the *project concept.* The information gathered to form the project concept *may* not need to be detailed or statistically reliable. If current information is insufficient, the information would be gathered before moving past the project concept phase. The *second level* of the INA would be conducted to determine the type and intensity of information needed to complete the *feasibility report. Finally*, an INA would be conducted to determine the type and intensity of information needed (Phase 6 information) to analyze and evaluate the project proposals during *IRM Phases 7 and 8.* The point is that the kinds, amounts and quality of data may change from one phase of the IRM process to the next. This concept is presented for you in tabular form on the facing page.

This distinction between the kinds and amounts of information needed is an important point. Currently, it seems as if a lot of detailed information is sought from the beginning of the planning effort. The consequences of this might be a high investment of money and time on a project that we later decide is infeasible. Conversely, we may charge ahead with a project that is really not feasible because we have already incurred significant expenses. Generally, we should be able to move through Phases 1–4 without a great deal of detailed information.

Now that we have told you about all the different levels of GIS applications we want to add *a cautionary note about GIS applications.* It's possible that it may be easier to move through IRM Phases 1–5 without using GIS. You may not want to use GIS until you have detailed information. If drawing polygons is a cumbersome process on your GIS software then you should carefully consider the costs versus the benefits of using GIS early in the IRM process.

Our team concluded that the early use of GIS is worthwhile. Whatever you decide, have fun and take advantage of this great new technology!

TABLE 3

INFORMATION INTENSITY & RELIABILITY*
NEEDS DURING THE I.R.M. PROCESS
(EXAMPLE: SPOTTED OWL HABITAT**)

INFORMATION NEEDS ASSESSMENT FORMAT	PHASE 2 *(CONCEPT)*	PHASE 4 *(FEASABILITY)*	PHASE 8 *(PREFERRED DECISION)*	PHASE 13 *(MONITOR)*
PRODUCT	GROSS MAP OF POTENTIAL HABITAT FOR SPOTTED OWLS.	PREDICTED OWL HABITAT FROM STAND EXAM DATA***	FIELD VERIED MAP OF CORE(S), TERRITORIE(S) IN PLANNING AREA	UPDATE OF ACTUAL POST PROJECT CONDITIONS
LAYER	AERIAL PHOTO MAPPING OF POTENTIAL HABITAT	STAND EXAM INTERPRETATION OF POTENTIAL SPOTTED OWL HABITAT	STAND AND OR CUTTING UNIT DISPLAY OF ALL OWL CORE & TERRITORY AREAS	UPDATE PHASE 8 LAYER WITH SPECIFIC POST PROJECT INFORMATION
FEATURES	VEGETATIVE BOUNDARIES	REFINED VEGETATIVE BOUNDARIES FROM STAND EXAM DATA	COMPLETED SPOTTED OWL SURVEY TO REGIONAL STANDARDS COMPLETED DURING PHASE 6	"DITTO" ABOVE STATEMENT
ATTRIBUTE(S)	SPECIES, DENSITY, SIZE CLASS, SLOPE, ETC.	SPECIES, DENSITY, SIZE CLASS, SNAGS, ETC. FROM STAND EXAMS	FIELD VERIFIED (PHASE 6) SPOTTED OWL HABITAT(S) BY COMBINING REFINED STAND EXAMS & SURVEY INFORMATION	"DITTO" ABOVE STATEMENT

* THIS CHART DEMONSTRATES HOW RESOURCE INFORMATION RELIABILITY AND INTENSITY USUALLY INCREASES AS YOU MOVE THROUGH THE IRM PROCESS. THIS EXAMPLE IS IN NO WAY TO BE CONSTRUED AS THE RECOMMENDED METHODOLOGY FOR SPOTTED OWLS. THE INFORMATION NEEDS OF EACH SITUATION MUST BE INDEPENDENTLY EXAMINED.

** ONE COMPONENT OF THE TES HABITAT LAYER

*** THIS COMPONENT, ON SOME PROJECTS, MAY NECESSITATE FIELD VERIFIED (PHASE 6) INFORMATION AT THIS POINT. PROJECT FEASIBILITY COULD BE DEPENDENT ON THIS COMPONENT. THUS, MORE RELIABLE DATA MIGHT BE NEEDED AT PHASE 4 THAN SHOWN IN THIS EXAMPLE.

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A hearty thanks to all the people who have assisted in the development of this guidebook. Special thanks to those who have had an involvement on this project from beginning to end. It took real persistence to complete this task while maintaining work on their home units. These folks became known as the "Think Tank Gang". Feel free to call any of these "gang" members if you want advice or help. Their names follow:

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Wally Covington	Professor, School of Forestry, Northern Arizona University
Steve Dewhurst	Research Assistant, School of Forestry, Northern Arizona University

When the talking was done; here are three folks who brought the narrative concepts to life in front of the computer screen. Thanks guys.

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